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ABSTRACT

Intended to assist Agency for International Development officers, advisors, and health officials in incorporating health planning into national plans for economic development, this tenth of ten volumes in the International Health Planning Methods series deals with the relationship between health and economic development. In an introduction, W. Boyd Littrell discusses the three articles which make up this volume. Health, Income Distribution, and Source of Health Expenditures in Developing Countries, by Milton I. Roemer, addresses the issues of income and health spending. To improve the general health of the population, he suggests increased public sector spending for health services. In A Systems Perspective on Health and Development, Paul O. Wooley, Jr. (1) summarizes the issues associated with the definition and measurement of health and (2) describes the uses and limitations of various methods, particularly as related to less developed countries (LDCs). Theodore D. Woolsey's paper, Needed Development Research for Measuring the Health of Populations in the LDCs, first sets out eight principles clarifying the meaning and importance of "health." He then summarizes key issues in the health and development dilemma before discussing the effects of improved health upon socioeconomic development. To bring the needed clarity to this matter of health and development, he recommends systems analysis. (YLB)

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Health or Wealth

A Compendium of Papers on Health and Economic Development

CE 024 237

U.S. DEPARTMENT OF HEALTH, EDUCATION, WELFARE
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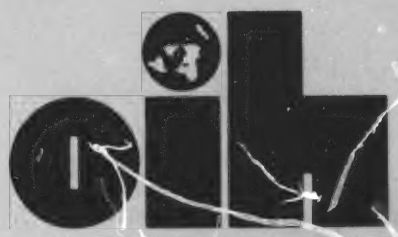
A Compendium of Papers on Health & Economic Development



U.S. Department of Health, Education, and Welfare
Public Health Service
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PREFACE TO THE SERIES

The International Health Planning Methods Series has been developed by the Office of International Health, Public Health Service on request by the Agency for International Development.

The series consists of ten basic volumes which cover a variety of health issues considered vital for effective development planning. These ten volumes are supplemented by six additional works in the International Health Reference Series, which list resource and reference material in the same subject areas.

The International Health Planning Methods Series is intended to assist health sector advisors, administrators and planners in countries where the Agency for International Development supports health related activities. Each manual attempts to be both a practical tool and a source book in a specialized area of concern. Contributors to these volumes are recognized authorities with many years of experience in specialized fields. Specific methods for collecting information and using it in the planning process are included in each manual.

The six supporting documents in the International Health Reference Series contain reports of literature surveys and bibliographies in selected subject areas. These are intended for the serious researcher and are less appropriate for broad field distribution.

The volumes in the International Health Planning Methods Series contain the collective effort of dozens of experienced professionals who have contributed knowledge, research and organizational skills. Through this effort they hope to provide the AID field officer and his host country counterparts with a systematic approach to health planning in developing countries.

PREFACE TO VOLUME TEN

This volume deals with the delicate relationship between health and economic development, expressed here dramatically as a choice between health or wealth. It is the tenth volume in a series of works known collectively as the International Health Planning Methods Series.

The series was produced by the Office of International Health on request of the Agency for International Development to provide AID advisors and national health officials in developing countries with critically needed guidelines for incorporating health planning into national plans for economic development.

This volume consists of three authoritative articles by recognized experts in the field of international health. The authors are Dr. Milton I. Roemer, Professor of Public Health and Preventive Medicine at the Medical School of the University of California, Los Angeles; Theodore D. Woolsey, former director of the National Center for Health Statistics; and Dr. Paul O. Wooley, Associate Professor of Health Planning at Pennsylvania State University.

These three articles are discussed, furthermore, in a detailed and very perceptive introduction written by Professor W. Boyd Littrell, Department of Sociology, University of Nebraska. Given the scope of Professor Littrell's introductory comments any detailed remarks about specific papers here would be redundant.

Preparation of this volume was undertaken for the Office of International Health by CPI Associates, Inc., Dallas, Texas. CPI was originally contracted in 1976 to develop alternative methods of disseminating and developing country-specific health information. Analyses of existing documents, a survey of users of country-specific information, and a conference on the subject followed. The papers in this volume mark the culmination of that process and serve to focus clearly the issues and dilemmas of health versus development investments.

The basic dilemma is frequently expressed in the form of the following questions: Is economic development essential for improved health, or is improved health required for economic development?

These three papers point out that neither alternative is very promising unless supported by reliable assessments of local health needs and resources. A suggested middle path includes identification of specific health sector targets, upon which public spending can be concentrated to make a maximum impact upon overall health improvement.

The contributors to this volume have frequently expressed personal points of view with reference to specific health projects. While their viewpoints generally coincide with organizations or agencies with whom they are associated, the material in this manual should not be construed to reflect the official policy of any agency or organization.

Paul I. Ahmed
Project Officer
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INTRODUCTION

The three essays in this volume address a very difficult dilemma regarding the relation between health and the economic development of less developed countries. The dilemma is this: economic development appears to be one prerequisite (or at least an important condition) of improved health of nations' populations. But improved health may itself be an important factor in promoting the economic development of less developed countries.

The dilemma is made more treacherous by the fact that one can invariably find exceptions to both horns. That is, one can find less developed nations that have far higher standards of health than others. This suggests that better health is not tied by some iron law to specific stages of development. Moreover, it raises the possibility that less developed nations may make important strides toward solving health problems without completing the stages of economic development. On the other side of the matter, some nations that have made important progress toward economic development continue to have profoundly severe health problems. India is a good example.

The dilemma of health and development poses formidable problems for policy makers in the governments of less developed countries. In what proportions should they allocate resources for economic development rather than immediate health improvement measures? By what calculus does one measure the political and the human benefits of immediate or short-run health improvements and compare them with the long-term benefits to public health that may accompany general economic development? Such questions have plagued officials in less developed countries for decades.

The dilemma of health and economic development has important international consequences as well as national ones. How can more developed countries assist less developed ones in order to improve health? Should the more developed countries think in terms of long- or short-range effects? And most difficult of all, what does one do when the more developed countries settle on a strategy--a long-range one, for example--in the face of a decision by less developed countries to move along opposite lines? Given the present state of knowledge there is no simple answer to the question of how developed nations can best assist the less developed ones. Because health refers to such immediate human problems, and because bitter human suffering and death may be in the balance, the health and development dilemma is both very difficult and urgently

important.

The dilemma of health and development rudely snubs many common ways of thinking. For example, we often think that we can reach a sound solution to dilemmas if we exert enough effort, collect solid information, analyze it according to the canons of science, and get the best "experts" to create a gameplan based on the newly acquired knowledge. But the example adumbrated in the preceding paragraph (in which two nations decided differently about how to improve health in the less developed one) defies the common approach. In that example, both nations were "right." That is, the less developed nation can easily justify the decision to move on a short-term basis. Moreover, it can do so appealing to the highest principles of morality (as distinguished from the more mundane demands of politics). Gross suffering demands immediate attention. The more developed nation, however, may also be right. A long-term strategy of development may indeed reduce the mortality and morbidity rates over a ten- or twenty-year period. Indeed, fewer people may die over the long haul.

Often, however, calculations of both long- and short-term strategies for improving the health of less developed countries come to ruin. Either no information exists or existing information is inadequate to calculate much of anything. The first two papers in this volume address the difficult problems associated with gathering information for health assessment and planning that can be useful in the less developed nations. Both authors recommend starting points for practical activities aimed at the development of information systems.

But we have already seen that the existence of good information may not be adequate to the solution of health problems in less developed countries. In some cases the "right" information may make little practical difference without consideration of the policy makers' situation including the choices that are available to them.[1] The fact that "right" information may fail to solve the dilemma suggests the need for alternative formulations of problems. I am pleased to report that the three papers in this volume attempt to do just that: force us to think differently about the dilemma of health and economic development. But the papers do more than discuss ways of looking at the problem. All of the authors suggest some technique or point of view that has immediate application to the assessment of health needs. The authors do more than tie hard knots into already tangled skeins. They untie some knots and unravel some of the more tangled elements of the dilemma.

The first of the three papers in this volume was prepared by Dr. Milton I. Roemer, Professor of Public Health and Professor of Preventive Medicine in the Medical School at the University of California, Los Angeles. Dr. Roemer has been associated with UCLA since 1962.

Prior to that appointment, he taught at The Yale University School of Medicine, Cornell University and at the Albert Einstein Medical School. He has served in the U.S. Public Health Service, the World Health Organization and the Department of Public Health in Saskatchewan, Canada. He has written more than a dozen books and monographs and numerous articles that have been published in professional journals and as chapters of books.

Dr. Roemer addresses the issue of income and health spending in developing countries. He advances a liberal thesis: increased public sector spending for public health will improve the overall health of the population in developing countries. He recommends that less developed countries adopt a goal of "equity" in their health policies. The aim of equity is to develop proportional expenditure among economic groups for health purposes. To illustrate his point Dr. Roemer examined expenditures for health services in Guatemala in 1975 and 1976. He found that about 18 percent of the population in that country accounted for about 70 percent of the health service expenditures. Conversely about 82 percent of the population had to be served with about 30 percent of the health service expenditures.

Dr. Roemer concludes from this that the inequity of health expenditures may be more important than the actual amount spent. Here Dr. Roemer's thesis is developed in a particularly informative way. He notes that there is a curvilinear relationship between national wealth as measured by GNP and public health as measured by infant mortality. He found that there was a definite association between GNP and infant mortality: the higher the GNP the lower the infant mortality rates. However, the curvilinear aspect of this association shows that the simple fact of increased GNP is not the only factor operating to reduce infant mortality. For example, some nations with relatively high GNP's have far higher infant mortality rates than other less developed nations with equally high GNP's. What, he asks, explains this difference?

Dr. Roemer concludes that some other factor (or variable, in the language of the social sciences) must be operating as well. He adjusted the GNP of twenty less developed countries with a measure of the degree to which income is distributed among different groups in the population. After making this adjustment he found that the relation between GNP and infant mortality is stronger. This finding means that the original association between GNP and infant mortality was mediated by some other factor: the distribution of income. In plain language this means that it is important to have moved along the road to development, but that the distribution of income within a country will also affect the quality of health at any point in the development process.

Dr. Roemer recommends that less developed countries attempt to equa-

lize the distribution of at least health related expenditures for different groups in the population. This must be accomplished by increasing public sector spending for health services. Dr. Roemer recommends that public spending be used to limit (but not to eliminate) private sector medicine:

> If public services are made effective enough, fewer and fewer people will purchase private ones. We need not be concerned about an extremely small elite...who will seek and pay for private health care...

Although Dr. Roemer does not specifically discuss the matter, his paper has implications for general policy among less developed countries. Dr. Roemer would agree that long-term commitment to economic development as a strategy for improving health should be undertaken. However, in the short-term significant gains can be made by increased public sector spending for health purposes. As these expenditures approach equity among the various groups within a country's population, one can expect measureable improvement in the health of the population.

If Dr. Roemer is right, he has found a middle road for less developed nations. They need not await the long term benefits of general economic development to improve the health of their people. By identifying specific targets within the population and by focusing spending on these poorer groups, the general health of the population will improve. The line of development in Dr. Roemer's paper suggests a concrete starting point for decisions about policy within less developed countries. The substitution of public spending in the health field for general income equality will help the less developed countries buy time: they can achieve short-term health gains without solving the difficult problems that attend the development of their entire economies.

Mr. Theodore D. Woolsey, author of the second paper is a statistician who served the Federal government for nearly forty years before his retirement in 1973. His distinguished career includes the directorship of the National Center for Health Statistics, Chief of the National Health Survey Division of that Center, Chief of Epidemiological Studies, Office of Health Statistics and Methods in the Public Health Service, Chief of the special surveys section of the National Office of Vital Statistics, among other positions. He has, since his retirement, served as a consultant in the area of health statistics and methods of research. He authored and co-authored nearly fifty professional articles and papers and has given numerous addresses.

Mr. Theodore Woolsey discusses the many problems of measurement associated with health issues in less developed countries. His discus-

sion is full of examples of the health vs. development dilemma. For example, less developed countries need highly accurate information in order to develop policies that will efficiently distribute the limited funds available for health purposes. This kind of accuracy requires highly organized efforts for collection and analysis of information. But less developed countries pose the most difficult problems for collecting such information, and must often face these problems with the least adequately trained personnel and the least developed information collection systems.

Part of the problem of data collection lies in the fact that less developed countries did not need highly accurate information in agrarian or pre-agrarian periods of their history. Therefore, there is little familiarity with the problems of data collection and relatively little administrative preparation for the task. Mr. Woolsey cites a recent study to illustrate his point. The study conducted by Nora P. Powell surveyed and tried to identify the official location of responsibility for vital statistics in 174 countries. Of these, 50 countries had no registration system at all, and in 19 countries it was impossible to determine whether or not there was a system of vital statistics registration. Only 47 countries had a centralized registration system; the remaining 58 countries had decentralized systems of registration. The point is obvious and dramatic: not only do many less developed nations not have highly accurate information, they have no information at all and often have no administrative machinery whatever to collect it.

Another debilitating knot in the health vs. development dilemma is the fact that the best information costs the most to obtain. And it is the countries least able to pay that need information the most urgently. Mr. Woolsey addresses the many problems associated with the collection of needed health information in an attempt to summarize choices available to the less developed countries.

Mr. Woolsey's paper summarizes the many issues associated with the definition and measurement of the health of a nation's population. He then describes the uses and limitations of various methods, particularly as the implementation of these methods relates to less developed countries. This discussion serves a valuable service. In one brief paper he summarizes the issues and does so in a style that can be read by the layman. Yet his discussion is sufficiently thorough, well organized, and well documented that one is prepared to move immediately to more technical writing on the subject.

But Mr. Woolsey does more than summarize issues and prepare a sound primer. He also assesses the way that various approaches to measurement might be adapted for use by less developed countries. He outlines a starting point for the development of health information in nations that

have no information gathering machinery whatever. He then suggests how different kinds of procedures that he has reviewed might be incorporated into successive attempts to improve information during ensuing years.

His recommendations begin with a discussion of the uses of mortality and morbidity information and with suggestions about how such information might be obtained. He discusses attempts to develop health information in the rural U.S. in the 1940's and he describes an effort to develop health information about two Eskimo communities on St. Lawrence Island in the Bering Sea. His discussion is thorough enough to outline the steps required to collect information under these difficult conditions. But the discussion is brief and masterful enough to avoid bogging down in details. The program he outlines relies upon the information gathering abilities of residents of the isolated communities themselves. And while the information may not be the most precise, Mr. Woolsey points out that it can be very useful information and that it can certainly provide a useful starting point.

Mr. Woolsey's paper could assist with the development of a symptom survey in a particular country. However, he suggests that the United Nations develop such a system for use in different countries. He outlines the program that the U.N. might undertake in order to accomplish this end. Once again his paper is sensitive to the need for careful technical definition, the practical needs of individual countries, and at the same time the need for involvement by an international agency that can help to get underway the gathering of needed information.

Near the end of his paper Mr. Woolsey ties a considerable amount of information presented in his paper to the larger issues of policy regarding the health needs of less developed countries. He claims that solid health surveys could be carried out in any less developed country in the world if international agencies were committed to the task. These agencies, as well as the governments of developed and less developed countries may be reluctant to undertake such research:

> The tendency is, quite naturally, to consider that services come first and that statistics are a luxury. But the more difficult it is to come by the money to provide health services or train people, the more necessary it becomes to have some trustworthy statistics to show whether the investment is paying off.

One final editorial comment is in order, and that concerns the mood of Mr. Woolsey's paper. Throughout, there is an underlying sense of urgency that "we get on with it." He refuses to be paralyzed by the

dilemma we discussed at the beginning of this introduction, and urges less developed nations to begin. This sense of action is tempered with a realistic sense (born of extensive experiences) of what nations can and cannot do. But the sense that "it can be done" which permeates the paper is a refreshing theme.

Dr. Paul O. Woolley is currently Associate Professor of Health Planning at Pennsylvania State University. He received his M.D. degree from Yale University in 1964. He has taught at the schools of medicine at George Washington University and Georgetown University. He has served as Medical Officer in the Office of International Health of the Department of Health, Education, and Welfare. Dr. Woolley developed the Syncrisis series, published by DHEW, which examines the relation between health and socio-economic development. He has co-authored the first four Syncrisis volumes, and is the sole author of volume 12.

Dr. Woolley's paper, "A Systems Perspective on Health and Development" begins by setting out eight principles designed to clarify the elusive meaning and importance of the word "health." One implication of his discussion is that policy issues surrounding the health needs of less developed countries may be rooted in the ambiguous character of health and disease. One of his eight "principles" identifies an important issue at the heart of the dilemma of health and development. "Health care exists," he writes, "in a means/end continuum." That is, health may be viewed as an end in itself--a human good that is worth seeking in its own right. It may also be viewed as a means to an end, for example, the role of health in economic development. Very different policies might ensue if one or the other of these were the sole concern of policy-makers and governments. But, Dr. Woolley reminds us, these two values of health can never be fully separated. Some confusion attends our discussions of health needs because we cannot help but look at health in two different, but closely entertwined, ways.

Dr. Woolley then summarizes some of the key issues in the health and development dilemma. He asks: "What is known about the role of socioeconomic development in the improvement of health?" He concludes, as do most international health specialists, that socioeconomic development does produce general health benefits, though the evidence is far more mixed than one might suppose. For example, do the industrialized nations really substitude such diseases as cancer, respiratory, and circulatory ailments for malaria and other bacterial infections? Do we substitute the malnutrition of obesity and related ailments for the malnutrition of calorie or protein deficiency? The issue is not as clear as some might think, which Dr. Woolley includes as a qualifier to his conclusion that development does improve health.

On the other side of the dilemma he asks what effects improved health

have upon socioeconomic development. He reviews numerous studies that explore this issue, and concludes tentatively that health does appear to be a factor in socioeconomic development "...although the nature of this impact is far less clear." (One regrets that Dr. Woolley did not review Alan Berg's contribution to this discussion.[2])

Having reviewed issues on both sides of the dilemma Dr. Woolley concludes that our information is too uncertain and too ambiguous to assess fully the relationships between development and health. But this very uncertainty and ambiguity becomes an issue to which Dr. Woolley turns his attention. He suggests that the uncertainty may result from the kinds of questions we ask. Perhaps it is pointless to ask whether development generally improves the health of the population or vice-versa. Dr. Woolley recommends that a careful analysis of the kinds of questions we are asking be undertaken. He proposes that systems analysis brings precisely the needed clarity to the matter of health and development. Such analysis would, he argues, help to clarify our questions and would enable us to use existing information in the most effective ways.

The title of Dr. Woolley's paper implies that the call for systems analysis applied to health problems in developing countries is a key purpose of his paper. Without in any way detracting from this recommendation I think there is an equally important conclusion to be drawn. He rightly warns that our very uncertainty about the questions we ask may prompt us to worry those questions so much that we lose other opportunities. We may be better off, he suggests, if we pose different questions than the one that underlies the dilemma that has been discussed in this introduction. This question is: "Which is the optimal strategy for improving health: direct investment in health expenditures or direct investment in economic development which will in time yield better health? Dr. Woolley's remarks on this matter are worth quoting:

> At this point it would appear that many countries are taking many different paths in dealing with their health and development programs. We should use these disparate attempts to increase our understanding of the development process and its relationship to health. Perhaps we need to redefine some of the critical research questions.

The papers presented in this volume summarize the issues surrounding a fundamental problem facing governments today: the relationship between health needs and the needs of economic development in less developed countries. The reader of this volume will have, when he or she has finished reading it, a grasp of the broader issues as well as directions for further reading that will rapidly fill details into the sketch presented

here. Policy makers in the developed countries will be challenged to reconsider some conventional wisdom. Health planners struggling with the many difficulties facing less developed countries will find assistance both in defining the questions to be asked and in finding answers to some questions they may now be asking. With this introductory task completed I invite the reader to engage the papers in the volume and to let them speak for themselves.

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References

1. For a more detailed discussion see, W. Boyd Littrell, "Editor's Introduction," Current Issues in Social Policy. Beverly Hills, CA.: Sage Publications, 1976.

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HEALTH, INCOME DISTRIBUTION, AND SOURCE OF HEALTH EXPENDITURES IN DEVELOPING COUNTRIES

Milton I. Roemer, M.D.

The relation of health to economic level both in families and nations has long been appreciated. In 1790, Johann Peter Frank spoke of "the people's misery as the mother of disease."[1] The very birth of the modern public health movement in Europe arose from the observation of the high prevalence of diseases associated with "the social condition of the poor."[2] Well before the origin of foreign aid programs, the health status of whole nations was recognized to be related largely to their levels of wealth.[3]

Health and Economic Level

In more recent years, the interdependence of health and the economic development of countries has been explored in greater detail. The sickness, disability, and premature death of people have come to be recognized as factors retarding their productivity and economic development, just as the poverty of nations has become understood as a major -- probably the most crucial -- determinant of the morbidity and mortality of their populations.[4]

Yet, as more has been learned about the complex of social and environmental factors influencing the health of populations, the relationships between health and wealth have come to require description as more than a simple direct linkage. The most widely used measure of a nation's economic level is its gross national product (GNP) per capita per year. Thus, the annual per capita GNP of Ethiopia, as of 1973, converted to U.S. dollars, was $83; of Brazil, $750; and, of the United States, $6,155.[5] The corresponding infant mortality rates (deaths per 1,000 live newborns in the first year of life) of these three countries were 162, 110, and 19 per 1,000 live births, respectively.[6]

Thus, while the general relationship between per capita GNP and infant mortality rates is clearly inverse -- the poorer the

country, the more of its newborn babies usually die before their first birthday -- it is also evident that the relationship between these two measures is far from perfectly proportional. United States wealth (as reflected in per capita GNP), for example, is 74 times greater than that of Ethiopia, and Brazil is about nine times wealthier than Ethiopia. The infant mortality rate in Ethiopia, on the other hand, is just about eight times higher than that in the United States and not even twice as that in Brazil. The same sort of irregular relationship applies to life expectancy measurements or other available indices of health status.

One need not expect a perfectly proportional relationship, of course, between two sets of measurements of different phenomena for a statistical correlation to be very high. But the striking fact is that exploration of the correlations between health measurements and the per capita GNP of countries yields many extreme deviations from a linear relationship; in fact, some of the associations are not even monotonic. This is shown in Table 1, in which 20 countries with per capita GNPs between $100 and about $1,000 are listed in rank order, along with their reported life expectancies at birth. The data are derived from a report of the World Bank, and the countries (while all in the "less developed" category) were selected to represent a wide range of economic levels, yet with statistical data considered to be reasonably reliable.[7]

More impressive than the generally positive correlation evident on inspection of this table are the numerous deviations from a perfect linear relationship. These deviations are graphically illustrated in Figure 1, which is based on the same data as shown in Table 1. The diagonal line has been determined by the "least squares" technique and shows the incline which would describe the relationship between per capita GNP and life expectancy, if it were perfectly linear. The numbers next to each point in the figure correspond to the number assigned to each country in Table 1.

Why should the life expectancy of Sri Lanka (#1) be so much above the regression line, while that of India (#2) is so much below this line, when both countries have approximately the same per capita GNP and are in the same general geographic region of Asia" Likewise, why should Mexico (#15) with a higher per capita GNP than Cuba (#13) -- and both in the same region, with rather similar cultural heritages -- have an appreciably lower life expectancy?

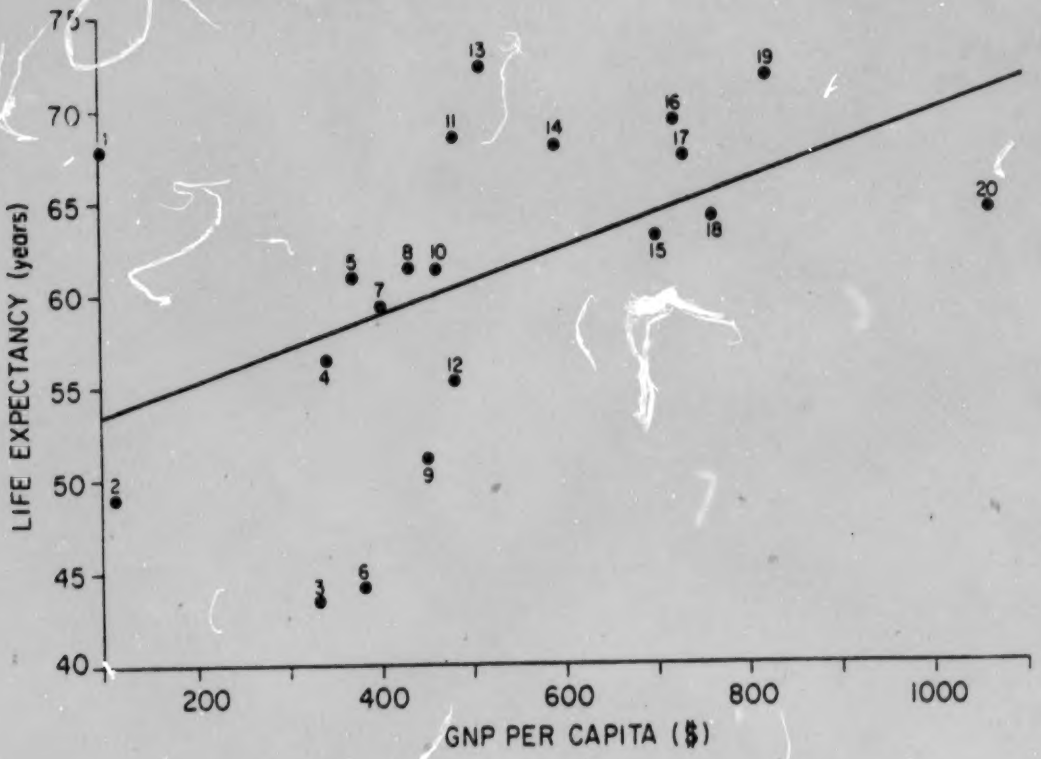
The Role of Income Distribution

It is obvious that factors not reflected by per capita GNP must be playing a large part. The number of such factors potentially exerting an influence on health status must be very great, but this

Table 1. National Wealth and Life Expectancy: Per capita Gross National Product (GNP) and average years of life expected at birth in twenty countries, about 1973.

Country	GNP per capita ($)	Life expectancy (years)
1. Sri Lanka	100	67.8
2. India	110	49.2
3. Ivory Coast	330	43.5
4. Turkey	340	56.4
5. Colombia	370	60.9
6. Zambia	380	44.5
7. Malaysia	400	59.4
8. Taiwan	430	61.6
9. Iran	450	51.0
10. Brazil	460	61.4
11. Albania	480	68.6
12. Peru	480	55.7
13. Cuba	510	72.3
14. Costa Rica	590	68.2
15. Mexico	700	63.2
16. Jamaica	720	69.5
17. Yugoslavia	730	67.5
18. Chile	760	64.3
19. Bulgaria	820	71.8
20. Venezuela	1060	64.7

Figure 1. National Wealth and Life Expectancy: Per capita Gross National Product (GNP) and average years of life expected at birth in twenty countries* about 1973.



*Note: The country represented by each numbered point is identified in the listing of countries in Table 1.

Sources are cited in the text.

paper hypothesizes that an important and measurable indicator of many of those factors is the distribution of wealth among a nation's population. The overall national wealth remains important, and we need not go so far as entirely "dethroning GNP" from its widespread use because of its inadequacies.[8] But ways should be found to adjust the basic information provided by this standard economic index to recognize at least some of the many other determinants of a people's level of living, including their health.

Fortunately, economists have also been long aware of the problem and have developed measurements of income distribution. One of the best established is the "Gini Coefficient" formulated by an Italian scholar to reflect the degree of equality or inequality in the distribution of income among various sectors (percentiles) of the population. Thus, in a population characterized by perfect equality -- where, for example, each tenth of the population received exactly one tenth of the national income -- there would be no deviation from an idealized egalitarian model and the Gini Coefficient would be zero. In a highly inequitable setting, where the upper tenth of the population received all the income while the other nine-tenths received none, the Gini Coefficient would be 1.0. As one would suspect, of course, each country of the world falls at some point between these two extremes -- the lower the coefficient reflecting the greater equality in income distribution.

The World Bank (International Bank for Reconstruction and Development) has calculated, from a variety of sources, the Gini Coefficients for 79 countries, including 18 of those shown in Table 1.[9] In order to attempt to make an adjustment of the per capita GNP data in this table for each country's income distribution, these data may be multiplied by the reciprocal of the Gini Coefficient; thus, the "adjusted per capita GNP" of more equitable countries would be raised and that of less equitable countries would be lowered. The results of these calculations, along with the same life-expectancy data and the infant mortality rates of each country, are presented in Table 2.

On the basis of the data represented in Tables 1 and 2, we may test the hypothesis offered above. That is, does an adjustment of the per capita GNP of a country for the income distribution in the population yield a higher correlation with measurements of the health status of its people than does the simple average per capita GNP alone? Coefficients of correlation were calculated by computer.

Health and Wealth -- With Adjustment for Income Distribution

It is found that the coefficient of correlation between the per capita GNP and the average life expectancy for the 20 countries in Table 1 is 0.495 and positive. Thus, despite the deviations from linearity noted above, the general relationship between national wealth

Table 2. National Wealth Adjusted for its Distribution and Health Status Measurements: Per capita GNPs adjusted by Gini Coefficients, average life expectancies at birth, and Infant Mortality Rates, about 1973.

Country	Gine Coefficient	Gini-adjusted GNP ($)	Life expectancy (years)	Infant Mortality Rate
Sri Lanka	.358	279	67.8	50.3
India	.461	239	49.2	139.0
Ivory Coast	.516	640	43.5	138.0
Turkey	.544	625	56.4	153.0
Colombia	.546	678	60.9	61.9
Zambia	.488	779	44.5	150.0[b]
Malaysia	.497	805	59.4	38.5
Taiwan	.317	1356	61.6	18.0
Iran	.473	951	51.0	160.0
Brazil	.553	832	61.4	110.0
Albania	.242[a]	1984	68.6	87.0
Peru	.571	841	55.7	53.6
Cuba	.242[a]	2107	72.3	28.7
Costa Rica	.429	1315	68.2	68.2

Table 2. Continued

Country	Gini Coefficient	Gini-adjusted GNP ($)	Life expectancy (years)	Infant Mortality Rate
Mexico	.558	1254	63.2	60.9
Jamaica	.558	1290	69.5	27.0
Yugoslavia	.333	2192	67.5	44.0
Chile	.487	1561	64.3	71.0
Bulgaria	.206	3981	71.8	26.0
Venezuela	.591	1794	64.7	52.0

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a. Estimated by calculating the average of Gini Coefficients which were reported for five other Socialist countries: Bulgaria (.206), Czechoslovakia (.183), Hungary (.235), Poland (.235), and Yugoslavia (.333).

b. Estimated on the basis of infant mortality rates reported by several other African countries; Zambia IMR data not available for the 1970's.

and life expectancy is weak but positive. When the same life expectancy figures are correlated with the Gini-adjusted per capita GNP data, as shown in Table 2, the positive coefficient of correlation rises to 0.624. It is evident, therefore, that adjustment of the per capita GNP of a country by its income distribution appreciably strengthens the positive correlation to its population's life expectancy.*

An equivalent dynamic is found to characterize the relationship between per capita GNP and infant mortality rates (IMR) of the series of 20 countries. The coefficient of correlation of the average per capita GNP with the IMR is negative, as would be expected, and 0.454. When the Gini-adjusted per capita income is related to the IMR, the negative coefficient of correlation increases to 0.509. (The somewhat lesser differential than for the life expectancy data probably reflects the less complete reporting of infant deaths in developing countries than of deaths at older ages; the latter death rates are the basis for calculating life expectancy figures.)

Beyond these statistical types of evidence of the influence of income distribution on health status indicators, one may take note of some of the social conditions in back of the numbers. The per capita GNPs of Sri Lanka and India, as noted, are almost the same, but in Sri Lanka the life expectancy is considerably higher and the infant mortality rate much lower. Both countries carry the heritage of the British colonial medical services, which were relatively systematic, and both were strengthened after national independence; there is no reason to suspect any differences in the reliabilty of the vital statistical records as such. In Sri Lanka, however, the Gini Coefficient (0.358) reflects more equitable distribution of the available income than in India (0.461). In both countries, the average income level is extremely low, there is great unemployment, and the prevailing standard of living is very poor. But since about 1970 Sri Lanka has been under the control of a "semi-socialist" coalition government, it has nationalized the plantations growing its principal export, tea, and it has introduced various other social reforms. Among these is a government policy of distributing each week a pound of rice free to 90 percent of the population, plus

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* If the adjustment of per capita GNP for income distribution were made by multiplying it by the reciprocal of the Gini Coefficient squared, the positive correlation coefficient with life expectancy would be strengthened even further. But the effect of the simple adjustment applied here should be enough to confirm the basic argument of the substantial influence of income distribution.

another pound at one-third of the market price.[10] No such equalizing program is found in India, and the difference is doubtless reflected in the infant mortality and life expectancy data.

Another illustrative comparison, as is clear from Figure 1, may be drawn between Mexico (#15) and Cuba (#13). Mexico's per capita GNP ($700) is appreciably higher than Cuba's ($510), but the distribution of wealth among the two national populations is very different. The Gini Coefficient of Cuba (0.242) suggests an equalization of income distribution more than twice as great as that for Mexico (0.558). Both countries have developed rather strong health service systems in their main cities, but in the rural areas, where most of the population lives, the improvements achieved in Cuba over the last 15 years have won worldwide attention.[11] The substantially longer life expectancy and lower infant mortality in Cuba compared with Mexico -- as well as with other Latin American countries of similar per capita GNP, e.g. Peru (#12), or of greater GNP, e.g., Costa Rica (#14) -- are doubtless referable to the equalization of income distribution achieved after the Cuban Revolution.

These observations are not be interpreted as passing political judgment on the socialist or communist ideologies found in Sri Lanka or Cuba, compared with other countries of similar wealth. The influence, however, of income distribution on health status would seem to be clear. Illustrative of corresponding effects of contrasting income distribution in two countries of very similar political complexion -- both being widely recognized as conservative — are the data for Taiwan (#8) and Iran (#9). The per capita GNPs of these two countries are quite similar, although Iran's ($450) is slightly higher than Taiwan's ($430). We know that Iranian wealth is largely due to its oil production, the earnings of which are concentrated in relatively few hands. Compared with Taiwan, its income distribution is noticably inequitable, as reflected by a Gini Coefficient of 0.473 versus 0.317 in Taiwan. The greater economic equity in Taiwan would surely contribute to explanation of that country's much longer life expectancy and very much lower infant mortality.

In spite of this general confirmation of the crucial importance of income distribution for health status, over and above the per capita GNP in a country, it is apparent from the data cited that income distribution is not the whole story. Even with per capita GNPs adjusted by the Gini Coefficients, the relationships to health status, while strengthened, obviously do not approach 1.0 or a perfect correlation. In none of the 20 countries examined is income distribution found to be completely equitable, as reflected by the

Gini Coefficients. Moreover, other factors in a population's living conditions and health service system must surely be exerting substantial influences on health status.

Equity and the Public Sector of Health Services

Focusing on health care systems, the issue of equity may be considered along other lines. Most important, how equitably are health services distributed in relation to the sickness needs in a population? Unfortunately there are few countries on which such distributional data are available. Indirectly, we may approximate an answer to this question by examining the sources of a nation's health expenditures, as between private and public sectors. Insofar as equity is to be achieved in health care distribution, the funds must generally be derived from public rather than private sources. Private expenditures are typically for the benefit of the individual or family that makes them, and the amounts vary with affluence much more than with health needs. For health services to be provided in equitable relation to needs, especially in developing countries, they must ordinarily be financed through public (usually governmental) sources.

Even the sources of total health care expenditures, however, are seldom available from developing countries. Such data are currently available for the United States and some of the more affluent industrialized countries, where national statistics are well maintained. Official reports from the United States government, for example, indicate that in 1976 the U.S. population spent about $140 billion for health purposes ($638 per capita) or 8.6 percent of GNP.[12] Of this amount, 42 percent was derived from governmental sources. The most recent data of this sort on developing countries comes from a World Health Organization study of 1961 experience.[13] Four developing countries were included in the study, with findings as follows:

Country	Percent of GNP Spent for Health	Percent from Public Sources
Chile	5.6	42.1
Ceylon	3.7	59.8
Kenya	3.6	42.0
Tanganyika	2.5	66.6

It would appear from the above data that, even in these developing countries, an appreciable proportion of health spending in 1961 must have come from non-public or private sources (ranging from 33.4

percent in Tanganyika to 58 percent in Kenya), in spite of the very low income levels of the vast majority of the populations of all these countries.

Private Sector Implications for Health in Developing Countries

While, as noted, current data on this question are scarce, a few recent observations indicate relationships which should cause serious concern. An investigation in Colombia, for example, found somewhat over 7 billion pesos devoted to health services in 1970-71; of this amount, about 51 percent was derived from private and 49 percent from public sources.[14] Recently, the author was able to make some rough estimates of health service expenditures, by source, in another developing country of Latin America.[15] The data apply to Guatemala for 1975 or 1976 and are presented in Table 3. In making these estimates, the figures on spending from public sources were obtained from official governmental documents and may be considered fairly reliable. The figures on spending from private sources come largely from calculations based on estimates of gross income earned from patients (excluding governmental payments) by private providers of services -- physicians, pharmacies, hospitals, etc. In every instance, the estimate was made on the most conservative level possible; for example, physician earnings from private patients, estimated by two different methods, yielded figures of $24 million and $25 million, but the recorded estimate was reduced to $21 million simply in the interests of conservatism. The $40 million figure for private drug purchases was based on a survey of 100 pharmacies, in which the investigators deliberately leaned on the side of minimal estimates. Moreover, no estimate is made of the undoubtedly significant expenditures of rural people, by money or by barter, for the services of traditional healers and midwives.

In all likelihood, therefore, the overall figures and percentages estimated for the private sector of health expenditures in Guatemala are understatements of the true relationships in this developing country. The data in Table 3 on public and private spending reflect the level of equity in delivery of health services to the Guatemalan population, in somewhat the same sense that the Gini Coefficient quantifies the uneven distribution of national income in most developing countries.

A study of Guatemalan social classes by a Mexican sociologist reports a distribution approximately as follows:[16]

Table 3. Estimated Expenditures for Health Services in Guatemala, by source and percentage distribution, 1975 or 1976.

Source	Expenditure	Percent
Ministry of Health	$ 34,980,000	23.6
Social Security Institute	31,677,000	21.4
Presidential Office	4,305,000	2.9
Municipalities	1,000,000	0.7
TOTAL from public services	$ 71,962,000	48.6
Voluntary health agencies	$ 4,500,000	3.0
Private drug purchases	40,000,000	27.0
Private Physician's care	21,000,000	14.2
Private hospitals	5,400,000	3.6
Private dental care	4,500,000	3.0
Enterprises & miscellaneous	1,000,000	0.7
TOTAL from private sources	$ 76,400,000	51.5
GRAND TOTAL	$148,362,000	100.0

Social Class	Percent
I. Landowners, large merchants, the hereditary elite, etc.	1
II. Steadily employed workers, civil servants, and rising "middle class"	17
III. Peasants, unskilled laborers, unemployed and indigent	82

If this social class distribution is approximately reliable, it may be related to the public and private sectors of the health service market in the following way: social classes I and II may be aggregated as 18 percent of the population. In so doing, however, the 21.4 percent of national health expenditures referable to the Social Security Institute must be linked to this more affluent aggregate since it contains the steadily employed workers covered by the social security program. On the other hand, the voluntary health agencies, accounting for 3.0 percent of the national health expenditures, are devoted largely to serving the impoverished 82 percent of the population. Thus, the health service expenditures devoted to the more affluent classes I and II, in contrast to class III, would summate as follows:

Classes I and II	Percent
Private sources	51.5
Voluntary agencies	-3.0
	48.5
Social Security	+21.4
	69.9

Class III	Percent
Public sources	48.6
Social Security	-21.4
	27.2
Voluntary agencies	+3.0
	30.2

Rounding off these figures, the relationship of health service expenditures to the social classes of the population becomes: classes

I and II with 18 percent of the population receive health services costing about 70 percent of the money spent, while Class III with 82 percent of the population receives health services costing about 30 percent of the money spent. In graphic form, the relationship would appear as follows:

The imbalance illustrated above is based upon estimates from one developing country, but the same basic type of relationship would probably apply to most developing countries in the Third World. It is a relationship which not only spells extreme inequity but also obstructs health planning since planning is very difficult in the private market sector. It is a problem that cannot be solved within the boundaries of the health services alone, but involves total social and political policy with respect to taxation and other means of allocating a nation's resources.

Approaching Health Equity

As a practical matter, the more equitable distribution of resources for health care or indeed any purpose, is not likely to succeed through legal prohibition of private spending. Even in socialist countries, born out of social revolution, private medical practice has not usually been prohibited.[17] Instead, the equalization

of resources in relation to need has been approached by strengthening of the public sector. This has also been the strategy in Great Britain and other "welfare states." If public services are made effective enough, fewer and fewer people will purchase private ones. We need not be concerned about an extremely small elite -- one or two percent of the population -- who will seek and pay for private health care under any circumstances. If 98 percent of a population can be reached by a public system of health service, in proportion to health needs, a small fraction of inequity may be tolerated as a "safety valve" to avoid pressures in the system.

The attainment of fully equitable income distribution as a foundation for improvement of a population's health is a special goal of stupendous proportions. Income distribution approaching Gini Coefficients of zero are probably utopian. But the attainment of equity in health service distribution, through reasonable strengthening of the public sector of health care as a basis human right, is well within the reach of any nation with the commitment to this goal.

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A SYSTEMS PERSPECTIVE ON HEALTH AND DEVELOPMENT

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Nearly 70 percent of the world's poor live in lands where personal income and personal productivity are low. In general, these people have to worry about the essentials of daily living -- food, clothing and shelter, as well as health care and education for themselves and their children. Over the past several decades, systematic efforts have been made to improve both economic productivity and social services through the efforts of the countries themselves and through cooperative assistance of other more wealthy countries. An assessment of this point suggests that:

> Progress has been uneven and on the whole too limited to bring significant improvement in the economic well-being of the world's poor. Nor is it yet true that clear paths of growth have been discovered or that future progress is now assured. Today, the tasks of economic expansion in poor lands remain unsolved; they remain to challenge the world's morality.[1]

It is the purpose of this paper to review some of our knowledge derived from research on the relationships between health and socio-economic development. We will consider this relationship in the context of a pair of reciprocal questions: To what extent does improved health status assist socioeconomic development? To what extent does socioeconomic development of a country or region improve the health status of the population? While it may appear that the second question is a simple inverse of the first, this is not quite so. Behind each question is a set of assertions, i.e.: (a) that health-related services and programs impact not only the health and disease characteristics of a population, but also other characteristics such as education, work productivity, social cohesion, social mobility, etc. -- all broadly subsumed under the concept of socioeconomic development; and (b) that services, programs or activities in the social and economic sectors of society impact not only the sectors for which they were designed but also influence the health status of the population and the utilization of health services. Answers to these reciprocal questions illustrate the dynamics of these interactions.

Working from this basis, a systems perspective is offered on the relationship between health and development which may be of use in the context of development planning. First, however, it will be useful to summarize some principles surrounding the concept of health and socioeconomic development.

A. PRINCIPLES RELATED TO HEALTH

1. Health is an abstract concept for which there is no useful operational definition. The definition by the World Health Organization, suggesting health to be complete physical, mental and social well-being, is laudable but difficult to use on practical problems. Consequently, health is commonly measured negatively, using statistics of death, reported illness, medical consultations, hospitalizations, etc. In the past, increased life expectancy, high fertility, and population growth have also been seen as a problem and have become negative indicators of health.

Another method of defining health is through surveys of perceived health status and perceived need among consumers and providers.[2, 3] For example, data from the U.S. National Health Interview Survey[4] show that 87 percent of the U.S. population define their health as good to excellent. Only 3 percent of the population define their health as poor, and 9 percent define their health as fair. Similar data are available for many of the developing countries. For example, in Sri Lanka[5] approximately 6 percent of the population defined themselves as sick during a two-week period. Data from Colombia indicated that nearly 39 percent of the population experienced illness in a two-week period during the study.[6] These perceptions of illness reflect not only prevalence and severity of disease, but also are probably culture-bound. Thus, cross-cultural comparisons should probably not be made.

As a result of these problems in defining health, the planner is left with finding ways to reduce negative manifestations (e.g., disease rates) or to alter perceptual/behaviorial characteristics of the population. It is hoped (and assumed) thereby that the elusive "health" will result.

2. Disease is a nonrandom phenomenon. Disease clusters in individuals, in time and space. It is this clustering that allows the epidemiologist to determine the causes of disease, to identify populations-at-risk of disease in the future and to estimate the benefits of various program interventions. Because disease is not equitably distributed, it is possible to describe the attributes of a population with a specific problem.

For example, it is widely known that infant mortality is associated with low income, low educational status of the mother, maternal age, housing conditions, access to medical care, etc. Seeking to separate biologic from socioeconomic variables, Brooks[7] analyzed infant mortality data from more than 2,200 counties in the United States. He identified low education and the percentage of blacks in a county population as the two socioeconomic variables which have appreciable effect on infant mortality. These two variables account for the gross associations between infant mortality and housing and income. Similarly, Conover[8] has demonstrated the relationship between socioeconomic status and chronic illness in the United States. Our study of vitamin A deficiency in children confirms the clustering of this problem in a relatively small population with specific social, physical, and demographic characteristics.[9] From these and many other studies, there is clear evidence that the population in the lowest socioeconomic groups is, in the aggregate, at higher risk. In this case, low income is frequently a descriptor variable, not necessarily a cause. Indeed, disease and low income may frequently interact in a cumulative circular manner in which disease may account for downward social mobility.[8, 10]

Since disease is not randomly distributed in the population, it might be inferred that the utilization of health services will and should be nonrandom. If access to services remains relatively unhampered, utilization patterns should reflect the characteristics of symptomatic illness. The trend in the United States in recent years reflects this assertion. Although there may be some artifacts in the data, in the United States approximately 5 percent of the population uses one-third of all out-patient visits and 23 percent of the population uses nearly three-quarters of all out-patient physician visits.[4]

3. Disease is a process. We tend to think of disease and health as a dichotomy. Either I am sick or well. This is true only in a very few instances -- such as pregnancy or a fracture.* In general, most disease exists as a process along a continuum from health through various stages of illness. Since disease does not have a defined beginning point, but evolves slowly over time (e.g., the process of coronary heart disease is known to start very early in childhood), there are many points in the life of the individual or many points in the development of the disease process at which health care services and health-related services might be of benefit. This process characteristic of disease then creates problems of

* Of course, pregnancy may not really be considered a sickness. It is, nevertheless, a state of health requiring clinical professional care.

definition and measurement. The question becomes: "When, in fact, does illness occur and what criteria are used in its definition?"

4. Disease is multi-causal. We have been accustomed to think in terms of single cause/effect relationships in dealing with disease, because of the effectiveness of technology in the control of some communicable disease. We have learned that polio virus causes polio disease, but the presence of the virus does not explain why some children die, others are permanently paralyzed, and others have only minor symptoms. It is not only the virus, but also characteristics of the child, his/her resistance, physical activity, other infections, etc. that influence the severity of polio disease. Our understanding of the nature of disease shows that it is far more useful at this point to understand disease as the result of a set of interactions of specific biological, personal behavioral, environmental, and agent characteristics interacting in a "web of causation." 11, 12 Although this concept of many factors causing disease may at first seem confusing, it provides a mechanism for defining alternate ways of solving problems and provides the theoretical and practical basis for incorporating different kinds of health care providers in a primary care team.

To clarify this point further, a (true) description of a patient may be of value. The patient is a 68-year-old widow living on her husband's (fixed) pension in an urban walk-up flat. This woman has diabetes reasonably well maintained under the supervision of a physician at an ambulatory care clinic. During the winter the woman cannot (or feels she cannot) pay the rising rates on her gas bill and her gas supply is cut off. As a result, she now has no heat, no hot water, and no means to cook her food. In this setting she is eating cold canned food. After a few weeks she develops a cold, her diabetes goes out of control, and her respiratory infection progresses to pneumonia. Acutely ill, she comes to the ambulatory clinic, is evaluated, and is placed in a public hospital for care. At the end of four weeks her condition has stabilized and she is discharged from the hospital -- back to the same, unchanged setting. Obviously, one might assert that in addition to medical care, effective health care involves other kinds of services to this patient if her health is to be maintained.

Our former simple concepts of single cause/effect relationships in disease do not explain the differences in disease distribution or severity in different populations or in different countries. Understanding disease as the result of a set of interactions of specific biological, personal behavioral, environmental, and agent characteristics (the web of causation) results in an understanding of the ecology of health and the ecology of disease. This provides the basis for

developing new means to deal with health problems.

5. In the developing world there is a close relationship between illness (morbidity) and mortality. In these countries the leading causes of death are heavily weighted by the infective and parasitic diseases. Hidden behind these causes is the problem of malnutrition, especially in children. While these infectious diseases are the causes of death, they are also the common causes of illness in the population. In the "developed" world there is a strong disjunction between causes of death and morbidity. Arthritis is the most prevalent chronic condition in the United States, but hardly a cause of death. In the developed world death statistics tell little about the quality of life or health. In the developing world these death statistics are still (unfortunately) quite useful descriptors of the state of health of the populations.

6. There is a coincidence of health problems. Just as disease clusters in time and space, for any individual, health probelms also cluster together. For the populations of the developing world, disease does not occur in isolation. The child who dies of measles also is malnourished, has one or several kinds of parasites, has several sick or malnourished siblings, and comes from a large family in the lowest socioeconomic level of the population. The occurrence of measles as a killing agent is not an isolated event. Indeed, prevention of the measles may not even prevent the death. To understand the dynamics of health and disease in these populations, we must recognize problems not as isolated entities, but rather the simultaneous occurrence (hence coincidence) of several problems.[9]

7. Health care exists in a means/end continuum. Health care is provided as the means to an end, the end being improved health status, and commonly thereby improved social or economic productivity. This improvement in health status is generaly defined objectively and many of the technologies to achieve this improved status can be identified. There is generally strong social consensus to support investments in services that lead to clear health status improvement.

Hoever, health care is also provided as an end in itself. The provision of health care is generally seen as a social good; it represents the caring and humanitarian functions of society and is an expression of the human value orientation of society. It is this orientation that supports the contention that even if outcomes cannot be changed, it is the responsibility of the health sector to take care of the sick. It is in this dimension of health care as a social value that there is far less consensus about how much care is enough.

Furthermore, the confusion of means and ends, treating health

care as a homogeneous aggregate, explains the absence of a relationship between health resource inputs and health status outcomes. Martini, et. al.[13] have commented on the need to move away from traditional health indices toward measures that take into consideration the different patterns of care and the social and behavioral aspects of health. Similarly, Elinson[14] has discussed the problem of the lack of sensitivity of various measures for establishing cause/effect relationships between health resource inputs and outcomes as required under recent health planning legislation in the United States. Abel-Smith[15] has commented on this problem in the context of planners, economists, and physicians having to agree on acceptable outcome measures for health actions.

Another way of viewing health care in the means/end continuum is to observe that the provision of health care may also be used to meet other nonhealth social needs. The health services may function to promote social cohesion or personal security or to illustrate social equity. Abel-Smith[15] comments, "In a country rent by tribalism, a health service which treats the sick equally, irrespective of tribe, color or religion is daily teaching the message of equal citizenship and promoting a sense of national unity."

It would appear that the common aggregation of health services data ignores these means/end conflicts in the provision of health services. For planners to assist the society in identifying the potential impacts of various health programs, it will be necessary to distinguish between those oriented toward changing health status and those oriented toward providing care for the sick or some other social goal.

8. No matter what the resources, there are many health needs which remain unmet.

> It may perhaps also be said that mankind has arrived at a crossroad in that health services that could be offered to individuals and populations were previously limited by lack of scientifically based knowledge. Now we have reached the point where the limiting factor is not knowledge, but resources. Even the richest country in the world would not be able to offer optimal health services to both individuals and communities in prevention, cure, and rehabilitation in the combined field of somatic, mental, and social diseases.[16]

Thus, choices are made about the allocation of resources, sometimes through explicit allocation decisions, other times resulting from the aggregate response of providers to the pressures placed upon them in the marketplace. While this problem is clearly evident in the developing world (see, for example, 17, 18, 19), it is also true in the "developed" countries. For example, in the United States, although Medicare and Medicaid have reduced financial barriers to care for some segments of the population and the data[4] show increased accessibility to care for all segments of the population (poor, non-poor, and minorities) during the period 1964-1973, there are many health needs that remain unmet. Many of these needs are problems for which cost-effective technology exists, problems that could well be met in a primary care setting and on which there is fairly clear consumer and provider consensus on the need for action. This is especially true in the area of preventive services. Data on immunizations in the United States indicate that only 67 percent of children under five have been immunized against measles, 60 percent of children under five have been immunized against rubella, two-thirds of the children under age 15 are protected against polio, and only three-fourths of those under five have been immunized for the triple childhood diseases of diphtheria, whooping cough, and tetanus. Unfortunately, the trend during the last ten years has worsened. As also might be expected, the immunization rates for the poor and minorities are much worse than for the general population. By all accounts these are unacceptable coverage figures for those preventable childhood diseases.

What we must recognize is that there is allocation of health services in every society. What we need to assess is how good or bad this allocation is and the mechanisms by which it occurs. Gish[20] has commented upon the value content of planning decisions and the risk that the professional interests of the few may be destructive of the needs of the many. Crane[21] summarizes his personal experience with such a problem.

B. PRINCIPLES RELATED TO SOCIOECONOMIC DEVELOPMENT

1. Socioeconomic development implies improvement along both social and economic dimensions of the society.

> It is now recognized that the distinction between economic development and social development is no longer tenable, even in terms of productivity and profit. Nevertheless, development has often been conceived of primarily in economic terms, since substantial economic changes are necessary for the achievement of many social goals. (Consequently) socioeconomic development includes development in the health field.[22]

The measures of economic development commonly are quantitative positive indicators such as growth in gross national product or increase in per capita productivity. Some of the economic indicators may be descriptive of activities of particular sectors, such as total agricultural productivity or industrial productivity. Measures of social improvement are commonly both positive and negative. Such indicators reflect progress toward social goals, e.g., increase in literacy rates, lowering of infant mortality rates, decreases in crime, etc.

2. A fundamental problem in socioeconomic development is the scarcity of resources. There is little disagreement that one of the problems for development is the relative scarcity of resources. These resources includ such obvious resources as investment capital, physical facilities and equipment, suitable technology, a skilled work force, and organizational systems for the distribution of goods and services. However, the resources for development are not merely the economic resources of capital, but also the human resources: a healthy, motivated, and skilled work force.

> The motivation and attitudes of man are essential elements in the process of population and output change, an emphasis which contrasts with the more conventional concern over a nation's material and physical inputs in the process of economic and demographic advance.[1]

This would imply that an adequate supply of human resources may well be essential to socioeconomic development. Others (e.g., Mushkin[23]) have suggested that humans should be viewed as capital resources in which investment, especially in the form of health and education, is necessary to make them productive. This theory suggests that health services (among others) increase the resources available for socio-economic development.

3. Resources which are available are neither randomly nor equitably distributed. Just as we have suggested that health and illness are not randomly distributed in society, so, too, proverty and wealth are clustered in selected segments of the population. The extent of such maldistribution of economic resources and its impact on the population have been illustrated in several of the Syncrisis studies.[18, 19] An obvious concomitant of this is the phenomenon of "cumulative advantage"[24] in which those who have resources, capital, education, health, or land are able to generate further resources. This phenomenon of cumulative advantage tends to increase even further the inequity of resource distribution.

4. The economic product of modern society is not homogeneous in its benefits relative to health. The general assumption has been that the increased production, income and consumption are uniformly health-promoting. The increase of life expectancy with economic development and the differential in death rates associated with socioeconomic class have tended to support this assumption. However, once there has occurred the decline in infectious diseases which occurs with early modernization, the rise in per capita income is paralleled by the rise of adult chronic non-infectious diseases: heart disease, cancers, cirrhosis of the liver, etc. While this "disease substitution" may simply reflect humans' mortality, Eyer[25] has suggested prosperity as a cause of death.

Waldron and Ricklefs[26] have suggested that the general correlation of economic development with life expectancy breaks down into two parts: below about $700 GNP per capita, life expectancy rises with increasing per capita product; over $700 GNP, there is no relationship between per capita product and life expectancy. Using these and other data, Eyer[25] has written that "a small part of modern economic product is unequivocally health-promoting, and that this part can have a large impact on population health very early in development if the national leadership makes its production and equal distribution a first priority."

If it is generally true that economic development has both health-promoting and health-detrimental characteristics, it would appear that development should not be examined as an aggregate, homogeneous phenomenon. From this perspective, it is probably appropriate to suggest that the development characteristics of a country tend to be unique to that country and that it would be hazardous to generalize about the "benefits" of development.

5. The fundamental problem of investment is the taking away from today for tomorrow. A problem of developing countries is a shortage of all kinds of resources. A shortage today means that there are existing unmet demands and unmet needs. In this situation, investment implies increasing the shortage of today for benefit sometime in the future. The future benefit exists now only as a forecast of the investment planner — it may be defined by probabilities, sometimes only with uncertain hope. The present value of this future benefit is accordingly difficult to estimate.

A second difficulty arises in the determination and acceptance of a suitable time frame for the planned benefits. While it may be possible to tolerate shortages this year for benefits next year, as the future benefit becomes more distant, acceptability of that time frame is more difficult.

Finally, hidden behind all this is the question: "Whose shortage and whose benefit?" The investment question then becomes: "Who is to benefit and when?"

6. The cause-effect relationships in the development process have not been clearly defined. While the dramatic development processes of the various capitalist and socialist economies have been carefully studied, there is as yet no unified theory or empirical data set that explains the various successes and difficulties in socioeconomic development. Analysis of the success of various development projects or the failure of others have not yet produced a model for development that is either explanatory or predictive (e.g., 27, 28). The cause-effect relationships between resource inputs and social or economic outcomes still remain elusive. Abel-Smith,[15] Malenbaum,[1] and Navarro,[29] among others, have alluded to this problem.

C. WHAT IS KNOWN ABOUT THE ROLE OF SOCIOECONOMIC DEVELOPMENT IN THE IMPROVEMENT OF HEALTH?

As was mentioned earlier, it has generally been believed that the health of populations has risen concomitantly with improvement in other dimensions of socioeconomic development such as productivity, income, education, and the like. An extensive investigation of the historical changes in human life span and mortality over long periods of time has been reported by Acsádi and Nemeskéri.[30] Data and conclusions from several studies of more recent health and disease trends are summarized below.

1. The common explanations for improved health (usually defined as decreased mortality) are the following:

   a. the application of medical technology and mass campaigns to diseases such as malaria and smallpox;

   b. the extension of basic health services, both preventive and curative, to provide greater coverage of the population; and

   c. the effects of general economic development, including improved nutrition, education, income, and social legislation.

Usually it is difficult to separate the effects of any factor because all three processes commonly occur simultaneously.

To assess the relative impacts of the three factors above, Gray studied the effects of malaria control in Sri Lanka.[31] He selected Sri Lanka because, being an island, it was a relatively closed system, it had made remarkable strides both in malaria control and in the development of basic health services, and it had a good data base. The study showed that prior to malaria control there was a linear correlation between malaria and death rates by age and cause. Malaria explained the differential between high and low death rate areas and the effects of malaria overrode the effects of other activities (e.g., provision of health services, sanitation and H_2O supply, etc.). Gray suggested that in this instance control over malaria was a necessary prerequisite to lowering the death rates -- malaria control contributed approximately 24 percent to the decline.* While malaria control explained 24 percent of the decrease in death rates, he concluded that most of the decline (approximately two-thirds) was explained by general factors (e.g., nutrition improvement and economic development), not by control of malaria or by the extension of general health services throughout the island.

Gray extended his analysis to data from Guyana, Guatemala, Mexico, and Venezuela with similar results: that "general" factors explained more of the change in death rate than did disease-specific activities. The findings of Gray support earlier (controversial) arguments advanced by Fredericksen that a rise in living standards was responsible for virtually all of the spectacular postwar mortality decline in Sri Lanka.[34] In many papers Fredericksen implied that this conclusion extends to many other nations.[35, 36]

2. McKeown and Lowe[37] have analyzed mortality trends during the past century and a half for infectious diseases of childhood, using data from England and Wales. From their data only the changes in polio and diphtheria mortality can be explained by the application of specific medical technology or public health programs. The dramatic decreases in measles, scarlet fever, and pertussis deaths in children cannot be explained by either specific medical technology,

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* Consequently, Gray concluded that malaria control explained only 10 percent of the population increase in Sri Lanka during the postwar period and was, therefore, an important but not major factor in the population growth of the country. This disputes the earlier conclusions of Newman[32] (who estimated in 1965 that 60 percent of the population increase was accounted for by the eradication campaign) and Barlow[33] who used Newman's data to develop a method for measuring long-term effects of malaria eradication on per capita income.

public health, or medical care services. Their conclusion is that the decrease in death rates from these latter diseases must be attributable to the more general effects of socioeconomic improvement, including better nutrition, housing, and social legislation including hygienic changes.

3. Similar patterns are seen with other diseases. The changes in malaria and typhoid fever in the United States can be directly ascribed to specific programs. The decline in tuberculosis, however, in the United States (as well as the diseases McKeown identified), can only be ascribed to the more general effects of social and economic change.[38]

4. Infant mortality and maternal mortality have decreased both in England and in the United States during this century; however, although all social classes have benefited from this general improvement, the gap between the poor and the rich has remained constant[37] suggesting that socioeconomic variables play a major role in this problem. More recent studies illustrating this point are cited above.

In our attempt to develop a model for predicting vitamin A deficiency in children,[9] regression analysis was used on many variables in a data set from Pakistan. Although we were not seeking to establish cause effect relationships, the analysis showed income to be the strongest predictor of malnutrition in the child population. In this instance a socioeconomic indicator (income) was a stronger descriptive variable for malnutrition than several health- and nutrition-related variables, including age at weaning, immunization status, or diarrheal disease.

Recently, Marshall[39] has argued that improved nutrition is the main determinant of mortality decline in the developing countries. Marshall uses a method of elimination, presenting evidence against the commonly accepted explanations of mortality decline. Some support comes from the work of Puffer and Serrano,[40] who showed that malnutrition is a very common contributory cause of death in children. However, whether nutrition has in fact improved over time or whether malnutrition has become less lethal remains unknown. Unfortunately, there seem to be no long term studies on changes in the prevalence of malnutrition.

These studies have been faulted on a number of grounds. Benjamin[41] comments that "the method of study is not entirely satisfying since it assumes that what cannot be explained by preventive and curative therapy or genetic selection is most probably attributable to environmental influence, though (generally) no specific influences

are identified." His book provides an excellent review of the methodological problems of research into social and economic factors influencing mortality.

More recently, Preston[42] has sought to overcome the methodological inadequacies of former studies. Preston sought to estimate the contribution of economic factors to declines in mortality during the twentieth century. He used cross-sectional relationships between national life expectancy and national income per capita during three decades of the twentieth century. His analysis showed an exponential relationship between national income per capita and national life expectancy with a steep rise in life expectancy as per capita income rises to about $400 (in the 1960s) and then a plateau at higher per capita income levels. During the twentieth century there has been an upward shift in the relationship between life expectancy and per capita national income. (During the 1930s, the plateau in life expectancy was not reached until there was a per capita national income of approximately $600.) From his analysis of regional and global data, he concluded that factors other than a country's level of income probably account for 75-90 percent of the increase in life expectancy for the world as a whole between the 1930s and the 1960s. Income growth per se accounts for only 10-25 percent. While the estimates are not meant to be precise, they do specify orders of magnitude. From these data Preston asserts that it is possible to rule out malnutrition and literacy as major contributors to life expectancy because income operates on mortality through such factors as medical and public health services, nutrition, and literacy.

A further conclusion of his study is that mortality has not become disassociated from standard of living during this century. He concludes with a seeming paradox: "that income has been a trivial factor in recent mortality trends and . . . that it is still a critical determinant of mortality level . . . the data suggest that mortality has become more responsive to income in the range of greatest interest," i.e., in the countries with the lowest per capita income. Preston comments on the seeming inconsistency by noting "the point is simply that mortality is subject to multiple influences."

From these contradictory studies it might be useful to be reminded that the benefits of development are not necessarily homogeneous. Some of the contradiction may derive from the mix of positive and negative benefits of the developmental process. The vast literature on the epidemiology of the chronic diseases which links these diseases to modern lifestyles and environmental characteristics bears ample testimony. At a far more concrete level,

it should be noted that specific development programs, while leading to apparent economic benefits, may have detrimental effects on the health of the population. These detrimental effects may be obvious in the form of industrial accidents and poisonings, occupational hazards, or contamination of the physical environment. Some of the detrimental effects may be more subtle. For example, Gross and Underwood[43] studied the impact of the development of sisal farming in a region of Brazil. Although there were economic benefits to be achieved from the sale of sisal in a ready market, their study showed that sisal farming demands such high energy costs on the part of workers in relation to the wages received for the work that systematic deprivation of food calories from the nonproductive family members (commonly children) becomes necessary for the workers to stay at their jobs. In this instance, the future health status of the population is mortgaged for current income, with a net loss. Similarly, excellent analyses of the health effects of the workplace are presented in Job Demands and Worker Health.[44]

Summary

From the foregoing discussion it is apparent that there is no conclusive evidence regarding the impact of socioeconomic development on improved health status. The last century and a half have witnessed remarkable improvements in our understanding of the causes of disease and the development of technologies to prevent and treat many diseases. The application of these technologies has had clear impact on the lowering of both morbidity rates and death rates in many instances. In others, the downward secular trends of morbidity and mortality appear to result from a more favorable relationship between humans and their environment. While the evidence is not conclusive, both theory and experience tend to support the conclusion that general socioeconomic development has a major beneficial influence on health.[45] Recognizing the multi-causal nature of illness and death, much of the discrepancy in research findings probably results not only from the methodological, definitional, and measurement problems, but also from the unique mix of biological, socioeconomic, and medical care factors which interact to influence health and illness in each society which has been studied.

D. WHAT IS KNOWN ABOUT HEALTH AS AN INPUT INTO SOCIOECONOMIC DEVELOPMENT?

This question is far more difficult to address, expect in a few dramatic examples. The most notable of these was the failure in building the Panama Canal until the endemic parasitic diseases were brought under control. There are similar examples in regions

of Africa made uninhabitable by malaria. In general, these clear-cut relationships between health factors influencing the outcomes of socioeconomic development efforts are uncommon. Current research to define the impact of health on socioeconomic development appears to be hampered by significant (though sometimes necessary) methodological compromises. Most research appears to fall into three general categories, as follows:

(a) Many studies seek associations between crude measures of health (e.g., crude mortality rates) and some indicator of socioeconomic development. These studies are frequently based upon aggregated data and as such they ignore the means/end issues in health care, the non-homogeneity of the benefits of economic development and the unequal distribution of health and economic benefits in the society. They also frequently ignore changing demographic characteristics of the populations over time. As a result, such studies provide interesting and sometimes useful descriptive characteristics of changes in the measures under study. The aggregation of data, however, frequently obscures stronger relationships. Similarly, studies based upon simple associations of variables do not provide insight into the causal mechanisms that are of great concern to the development planner.

(b) More precise studies link one specific health variable with another specific measure of socioeconomic development. Such studies, insofar as they control for obvious variables, allow for the identification of simple associations. In attempting to control for the interaction of other variables, many difficulties arise. Benjamin [41] comments on this problem with an example relating to the investigation of tuberculosis in Ireland. He notes that social class in the study was strongly correlated with housing, nutrition, occupation, and Irish birthplace. "If therefore there was an association between tuberculosis mortality and Irish birth there would also apparently be an association between tuberculosis and social class. Which was the direct and which the indirect of the correlations?" Susser[10] provides further examples of these problems and describes several methods of dealing with them.

Although studies of this type tend to be more helpful than those in group (a) above, the concern is in recognizing and assessing the impact of other variables that were not studied or controlled.

(c) A few studies attempt analysis within an ecological framework that identifies many interacting variables and seeks to identify the nature of the variables and their interaction.

Despite the above limitations, from the available data a few

generalizations can be made. From the occupational health literature there is clear evidence of the relationship between major respiratory incapacity, occupational poisonings, or major orthopedic limitations and some kinds of work productivity. Other examples of more subtle relationships follow:

1. The relationship between caloric input or deprivation and work productivity has been fairly clearly established. Winslow[46] has reviewed these data extensively and summarized findings from experiences in Europe during World War II and data from various development projects. This work is also summarized in Syncrisis I.[17] Winslow notes that where calorie supply is marginal, starvation may not be obvious, but malnutrition can be detected. The available calorie supply may meet the needs of survival but prove to be inadequate to provide sufficient physical energy to allow for work or to fight disease. Other studies have demonstrated that disease also makes calorie demands and might interact with malnutrition in influencing work productivity. Pollack and Sheldon[47] have sought to estimate the impact of disease on calorie demand.

In attempting to estimate the relationship between improved nutrition and increased productivity, Correa and Cummins[48] studied 18 countries for the period 1950-62. Their study showed that in nine countries of Latin America an increase in calorie intake made a contribution of nearly 5 percent to the rise in national product. In the economically deprived countries increased calorie intake had no apparent effect on the national product. Correa observed that the poorer the country, the greater the role of improved nutrition in its development. A recent report of the U.S. National Academy of Sciences has stressed the need for further research on the relationship between nutrition and productivity.[49]

2. Malnutrition, both as protein/energy malnutrition and vitamin deficiency, is clearly related to high morbidity and mortality, especially in children. Some of this morbidity may also have secondary effects such that malnutrition and vitamin A deficiency blindness may drain significant resources into a social support system.[9, 50, 51]

In 1961 Sukhatme[52] reported a method of estimating the incidence of hunger in the population based on the international reference scale for calorie requirements and on the variation in energy expenditure among men of the reference age group. Using this technique to estimate the prevalence of hunger and its distribution in various populations, he then studied the relationships between available calorie supplies as a percentage of calorie requirements and their relationship to death rates during the period 1955-59.

His data illustrate the striking statistical relationship between percent availability and death rate -- those areas with calorie availability less than 100 percent of requirements had far higher (generally approximately two times as high) death rates as compared with those areas having adequate or abundant food supplies. Benjamin[41] comments:

> The true mortality effects of food shortage are obscured by other causes of high mortality in tropical countries, e.g., malaria (though this is far less important than a decade ago) but the contrast between those regions of ample food is clear enough. Medical advances have made it possible to reduce the worst effects of qualitative deficiencies of food -- beriberi, scurvy, pellagra -- but sheer underfeeding cannot be combated by medical knowledge.

3. It is frequently suggested that there should be a relationship between health and education and between these two factors and socioeconomic development. For example, Correa[53] has suggested that the quality and quantity of the labor force determine the productive function of the work performed. His study of indices established for several countries reveals differences in working capacity resulting from variation in health status or nutrition or both combined. His study analyzes the connection between total production and the characteristics of the labor force in terms of the interaction of health and education.

Studies directed at determining the relationship between disease and mental performance have yielded contradictory evidence. For example, Stein and Susser, et al.[54] in a cohort study of the Dutch famine during World War II could not establish a relationship between malnutrition in childhood and subsequent mental performance in the adult survivors. A recent study by Freeman, et al. in Guatemala suggests that there is a relationship between malnutrition and mental performance.[55] Data from a study by Mönckeberg illustrated the interaction between nutrition and environment.[56] Guthrie and Guthrie[57] investigated the problem of malnutrition and cognitive development of children in various Philippine villages from an ecological perspective and identified the important though not single role of nutritional deprivation in delayed cognitive development. The study by the National Academy of Sciences[49] notes:

> Protein-calorie deficiency is responsible for the poor growth of children in the developing countries. It impairs their performance on

tests of learning and behavior and reduces their resistance to infection. However, the relative requirements to protein and calories and the effects of minimal deficiencies of each are highly controversial, largely because the requisite information is lacking. This is true for deficiencies of most other nutrients as well.

The Academy has suggested protein and calorie deficiency as a high priority for research. The importance of this area of research can hardly be overstated. If it is indeed true that nutritional deprivation in childhood influences subsequent mental status, it is probably that it then influences the intellectual capacity and work productivity of the work force. The Food and Agriculture Organization of the United Nations estimates that approximately 450 million people do not receive sufficient food (World Bank estimates run as high as one billion people).[49] Most of these people live in the developing world. If nutritional deprivation of these people and their children influences the subsequent intellectual capacity of the population, this may prove to be one of the most critical factors in socioeconomic development of the future.

4. Epstein and Weisbrod[58] sought to determine whether there was any relationship between subclinical disease (parasitism) and school achievement in a Caribbean island. Although they recognized that their study excluded those with acute illness, their interest was in determining the impact of low-level infection on educational performance. Their study revealed no relationship between subclinical parasitism and school achievement. In fact, socioeconomic status of the father was most strongly explanatory of the school performance of the child.

5. Recent studies of subclinical disease, in this instance subclinical anemia, have shown decreased work productivity in three populations: tea pickers in Sri Lanka, latex tappers in Indonesia, and weeders in Guatemala.[59]

6. As was suggested before, health programs and services can serve the achievement of socioeconomic development goals. Abel-Smith[15] noted the way in which health programs can promote social cohesion. Arnold[60] has described extensively the role of health programs from a social systems perspective.

Summary

From these and other data, it can be said that health is

derived from health sector actions and as externalities from actions of other sectors. Some of these externalities are predictable, others are not. Similarly, improved health appears to have some impact on the socioeconomic development of a country although the nature of this impact is far less clear. The apparent contradictions in much of the data suggest that the links between health and socioeconomic development are not only disease specific but also unique to the specific social-cultural-economic setting. This would imply that generalizations are inappropriate and that it is necessary to study the specific ecology of a health or development problem before useful recommendations can be offered.

Alternate Perspectives on Health Planning

At this point the reader may be a little discouraged and confused about the relationship between health and development. It appears from the various research studies which were discussed that in some instances, in some countries, socioeconomic development has been aided by progress in the control of disease or the promotion of health by improved nutrition or other means. In some instances health has benefited from improvement in socioeconomic status of the population. But the pattern is not striking or consistent. To many, this may suggest that there is no apparent order to the processes of health and disease or to the processes of economic and social development. Perhaps these processes interact, but not in any understandable way.

Alternately, it may be that the two questions that have been studied -- What is known about health as an input into socioeconomic development? What is known about the role of socioeconomic development in the improvement of health? -- are not the most useful ways of understanding the relationships between the processes of health and development. In general, the answers to these questions have summarized current research and thought on the problem from an analytic perspective. The research has sought to tease apart the complex issues into small, understandable pieces. It is difficult, however, to reassemble these pieces, to develop a synthesis without a conceptual framework. In the opening chapter of his book, The Systems Approach, Churchman[61] addresses this problem with the words:

> Suppose we begin by listing the problems of the world today that in principle can be solved by modern technology.
>
> In principle, we have the technological capability of adequately feeding, sheltering and clothing every inhabitant of the world.

> In principle, we have the technological capability of providing adequate medical care for every inhabitant of the world.
>
> In principle, we have the technological capability of providing sufficient education for every inhabitant of the world for him to enjoy a mature intellectual life.
>
> In principle, we have the technological capability of outlawing warfare and of instituting social sanctions that will permit the outbreak of illegal war.
>
> In principle, we have the capability of creating in all societies a freedom of opinion and a freedom of action that will minimize the illegitimate constraints imposed by the society on the individual.
>
> Etc.

This list is longer, but Churchman asks why we have not in fact succeeded, where in principle it is possible. His answer is in part "they are so interconnected and overlapping. . .that it is not clear at all where we ought to begin." And it may be that the problem is inappropriately framed. His book then suggests ways to think about and study the interconnections of problems -- the systems approach.

The systems approach is based upon a

> systematic and constructive inquiry into natural phenomena on the assumption of general order in nature . . . . The empirical sciences are viewed as active storehouses of information forming the substance of potential solutions to . . . issues. By this method scientific findings are used instrumentally, to construct a conceptual framework adequate to the understanding of nature as an integral network of ordered interdependency.[62]

The first assumption then is that at least some of the processes of nature are understandable, that we can take our discrete places of knowledge and put them together in a way that increases our understanding and is useful. The second assumption is that of interdependence of parts. In the context of health, the relationships

which exist between malnutrition, disease states, physical development, and activity have not been well documented. At a more global level "health services can only be understood as an integral part of the political, economic, and social structure of the country concerned, and revolution is not possible in one sector of society only."16

Although these two assumptions -- order in nature and interdependence -- are not especially remarkable, the systems approach built upon them provides a systematic way to observe, analyze, and synthesize our knowledge. All of us do it implicitly or intuitively -- studying, researching, analyzing professional and personal experiences -- synthesizing them into "professional judgments" or "common sense." Some of us are more skilled at this than others and a few are distinguished experts. The systems approach helps us take our implicit analytic and synthetic processes and make them explicit and logical. By doing so we become conscious of the questions we are studying and our means of making decisions about them. The systems approach thereby structures a logic of inquiry into problems.

A system then may be conceptualized as "a set of components which act with and upon one another to bring about a state of balance, interdependence, or 'wholeness'."[63] Systems may be further described as static or dynamic. In static systems the relationships among the component parts tend to be relatively fixed. Dynamic systems are characterized by shifting relationships among the components -- a kind of action and reaction resulting in a dynamic equilibrium. Most social systems appear to contain components in both dynamic and static relationships. The system can be observed interacting with the environment: "all other factors (outside the system) which impinge upon the system"[64] and are not under the active control of the system. The system draws resources from the environment and returns resources (new or transformed) to the environment.

Many authors have suggested that the study of the system and its interaction with the environment would be of special benefit in health. Hanlon[65] has suggested that human ecology as the science of relationships between humans and their environment attempts to develop a conceptual framework whereby the convergent complexity of the relationship of total humanity to total environment is recognized. Rogers[66] and Kilbourne and Smillie[67] have extended this concept into the study of health administration and public health. Arnold[60] has used this approach to describe health programs. More recently, Sims[68] has proposed an ecosystem approach for the study of nutritional status, suggesting that the strength of such a model is that it

et al.[9] have identified the need for such an ecosystem conceptualization

in the utilization of nutrition and health research in the developing countries.

Planning derived from a focus on the interactions between the system and its environment is sometimes called intersectoral planning. In this context, the term "environment" (those things outside the boundaries or control of the system) includes not only the physical environment but also social, economic, legal, organizational, and cultural environments. Since the system interacts with the environment by drawing resources from it and returning resources to it, the identification of these interactions may influence the outcome of a plan. We all recognize the way in which socio-cultural beliefs and economic status influence the nutritional status of the child. By careful attention to the study of environmental influences, however, we find that nutritional status is highly dependent upon hundreds of other environmental influences, e.g., trade policy, money policy, transportation policy, chemical research and pesticide policy, etc.[12] Consequently, insofar as these influences can be identified and utilized, it may be possible to change the nutritional status of the population with "non-nutritional" interventions. In Syncrisis I[17] an example is presented to illustrate how the health of the population might be changed by identifying and acting on the environmental influence. Similarly, thinking back to the example of the diabetic woman living on a fixed income it should become clear how different social and economic support systems might influence her health.

Intersectoral planning utilizes the interaction between the environment and the system to the benefit of the system. Where two systems interact (one is the environment for the other), it is frequently possible to design strategies that make use of their interaction for the benefit of one or both systems. (The nature of the interactions between systems in the health area has only recently come under scrutiny and evidence of the impact is beginning to appear in the literature on interorganizational relations.[69, 70])

A second characteristic of the systems approach to planning is that it identifies the interactions among components of the system as they relate to a specific output of the system. As was noted earlier, these interactions may be static or dynamic. Even if they are static, they may be subject to change. At a global level, such an approach could address the interrelations between hospital utilization, outpatient care, home visiting services, and possible preventive or rehabilitation services. In many instances the utilization of one service can alter the need or demand for other types of services. At a level of disease orientation, this approach would study the interactions of various health and disease problems.

For example, in a recent review of the literature a longitudinal study of children in India was reported. Data had been collected over several years on socioeconomic and demographic characteristics of the children and their families, perceived illness, intercurrent infections, receipt of immunizations, subclinical disease states (e.g., anemia, vitamin deficiency, under-nutrition, parasitism), and death. Unfortunately, from this perspective the interaction among the various problems of the children was never studied. Despite the excellence of the data and the thoroughness of the researchers, each disease problem was treated as an isolated entity. Consequently, data on the prevalence of anemia by age or socioeconomic status were available, but without access to the raw data, it was impossible to determine the relationship among anemia, measles, undernutrition, and socioeconomic or demographic conditions. There was no way in which the coincidence of the various disease problems could be established, no way in which the relative impacts of the various study variables could be determined from the data as presented. If the relationships had been drawn, we could have developed an understanding of the dynamics of the evolution of disease over time in a specific population. In turn, our understanding of the ecology of health and disease in this population would have been furthered. From that perspective it would then be possible to determine who needs what kinds of services under which conditions.

A third characteristic of a systems perspective on planning is the determination and specification of benefits or outcomes. The planner studies resources as inputs into the system and the changes that occur in these resources. He/she describes the system by its consumption of resources and by the change processes that occur. At the end, however, the planner's concern is with the product of the system. The planner is generally far more satisfied with a product which describes a change in the problem (e.g., X deaths prevented or Y births prevented) than one that describes a process (e.g., Z health education lectures) for which outcomes are not nearly so obvious. The need to specify benefits brings us back to the means/ends issue in health care that was discussed earlier. Abel-Smith15 comments on this problem:

> Those few economists who have penetrated beyond theories and generalities, and tried to come to grips with the realities of applying quantitative analysis to health, have come to appreciate the peculiar difficulties -- most of which have long been appreciated by health administrators. Rational planning, whatever technique is used, requires a measure of outputs. We need to be able to specify in precise quantitative form what we are trying

> to achieve so that we can establish a relationship between input and output -- between blocks of expenditure and measured steps towards the attainment of these objectives. There are, however, few fields where output is so hard to measure as it is in health services. We can within limits measure inputs -- the resources of manpower and goods which are used in health services. Even here, however, there are ugly problems . . . . We can measure the quantity of services . . . but these activities are only means to an end which is the improvement of health. They are, moreover, only part of the methods by which health is improved. The health of a population depends on many factors, such as nutrition and environment, which are not normally in the control of the health sector. Nevertheless, if we are to measure the output of health services, we will need to isolate the contribution they make to health status. This is clearly a formidable task.

Abel-Smith goes on to urge further research in this area to increase our understanding of the dynamics of health: "Let us deviate our main efforts to widening the choice of paths for developing countries, rather than to developing methodologies and models for later generations to use."

At this point it would appear that many countries are taking many different paths in dealing with their health and development programs. Some are more expensive than others, some are more successful than others. They operate within differing social and cultural philosophies, serving many social goals. We should use these disparate attempts to increase our understanding of the development process and its relationship to health. We obviously need further research in this area, but possibly first we need to rethink what the nature of that research should be. Perhaps we need to redefine some of the critical research questions. With the lack of a knowledge base and historical models for understanding the development process, but with rising expectations and demands for solutions to these complex problems the development planner is in a difficult situation. It seems unlikely that the issues will be resolved in the abstract. More likely, our knowledge will increase as the issues become resolved in specific contexts. It would be hoped that the development community will draw upon the theoretical and empirical knowledge base and adapt it to the specific setting in trying to understand the links between health and socioeconomic development.

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NEEDED DEVELOPMENTAL RESEARCH FOR MEASURING THE HEALTH OF POPULATIONS IN THE LDCs

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Introduction

The Conceptual Background and Use of Measures of Health

Scope of the Concept of Health Measurement. The term "health measurement" is often used extremely broadly to include not only the state of health of a population but also the health services the population received and even the conditions of the environment that are likely to affect health. In this paper, however, the term will be used to denote statistical data which depict the state of health of the people. Health measurement will include both data concerning morbidity and mortality and those classifications and dependent variables, such as disease condition, age, and sex, which help to pinpoint public health problems.

Another limitation on the scope of the concept as it is to be used here is that it will refer only to measurement of the health situation in the whole population and not simply among those receiving a particular health service. Thus, we shall exclude consideration of how one is to measure the health outcome for those persons receiving services. Such data, which might be a by-product of the record-keeping of services provided, relate only to those receiving the service, whereas we shall be concerned with those methods that provide information about all persons (or a sample of all persons) whether or not they receive services.

Finally, in discussing ways of measuring health and needed research we shall consider only those methods applicable to general health and omit those suitable only to producing statistics on a single disease or a narrow range of disease types. (For example, there are methods suitable only to the measurement of the prevalence of intestinal parasites and others suitable only to tuberculosis. To cover all of these would require a sizable book.)

Customary Uses of Statistical Health Measures at the National Level. The types of morbidity and mortality data that will be needed by a national government or a subnational jurisdiction depend greatly upon the uses to which the statistics are to be put. To some extent, these uses depend upon the type of health care system toward which the nation

is aiming and this in turn depends upon political goals. Some of the uses, however, are so fundamental that they are common to all conceivable health care systems.

Uses at the national level are also different from those made by local jurisdictions. The latter tend to be much more programmatically oriented; that is, the uses of health measures are of a kind that seek to determine whether the health services being provided are dealing effectively with particular health problems. It is likely, however, that in the world's less developed countries the local jurisdictions are almost exclusively producers of data rather than consumers. Nevertheless, the feedback of statistical results to the local health authorities is very much to be encouraged. Feedback provides the most effective incentive for improving the quality of the statistics for which the local authorities usually have a major responsibility.

We shall not attempt here to set forth potential future use of statistics on the health of the population of a subnational jurisdiction by the authorities there, but shall concentrate on those uses likely to be made by the national government of a developing country. These uses are of six types, and each type has its own implications for the kinds of data needed to satisfy it.

Type 1. Identifying emerging new problems in health. This obviously requires that the data be secured periodically. It also requires that the kind of health problem be identified as well as the demographic groups in which it is appearing. Some geographical detail is also extremely helpful since the problem may originate in the population of only a single district.

Type 2. Projecting forward in time to anticipate future problems or needs. This requires not only the same variables as does Type 1 but also a history of changes in the demographic composition of the population (from periodic censuses) so that one can observe changes in the demographic mix and estimate the possible effect of the continuation of these changes on the health problems.

Type 3. Assisting in the selection of strategies for dealing with health programs or in the selection of problems for priority attention in the face of limited resources. This use implies that the health measurement, to assist in the

making of choices, must permit the identification of the types of health problems faced and also some measure of their gravity.

Type 4. "Costing out" program and preparing budgets. The health data must be available in the form of national estimates of aggregates as well as population rates. To estimate costs it is necessary to know at a minimum the number of people who have to be reached, their general location, and their demographic distribution by age and sex.

Type 5. Public education and securing legislation or budgetary support. The statistics must be trustworthy and convincing. Those who are responsible for analyzing and presenting the data are practically never the same authorities who have control over the governmental purse strings. The statistics must, therefore, be of a type that will permit the preparation of a convincing case for budgetary support. Such presentations may also be used in public education campaigns.

Type 6. Measuring progress toward ultimate goals, measuring eventual program accomplishment (as contrasted with immediate output), and assisting in the process of program evaluation. Obviously if a sustained effort to deal with a health problem does not eventually show up in the form of more favorable trends in the health measure of that problem, the national government will wish to reconsider its methods of dealing with it and slow down the budgetary commitment until some more effective program can be devised. This means that the statistics must be sensitive to the kinds of health effects with which public health efforts can feasibly deal. If the method gives emphasis to health problems that no one knows how to deal with, its usefulness is limited. (This is the case, for example, with most of the customary indices of mortality now used in the industrialized countries of the world and points to the need for new indices -- a matter which will be discussed further in a later section).

Special Uses in Relation to Socioeconomic Development. The relationship of levels of health and socioeconomic development is known to be complex, but the nature of the interactions that can be expected is not well understood. There have been case studies (e.g., mortality in Sri Lanka) in which the interactions have been studied in some depth, but these are exceptional. It is safe to say that a developing economy and educational system will often be accompanied by reductions in mortality and that these reductions will precede any substantial fall in the trends of fertility, thus leading to a temporary increase in rates of population growth. But whether the socioeconomic development causes the mortality reduction, or vice versa, cannot be conclusively demonstrated. Either can occur without the other. Probably both kinds of cause-and-effect sequences occur simultaneously, and it is fairly certain that educational and industrial development, rising per capita income, and more choice in the ways income is spent bring about shifts in the kinds of health problems experienced as well as changes in demographic distribution.

In the case of reduced levels of chronic disability, resulting from reductions in malaria incidence or the common parasitic infestations, for example, the immediate effect is almost sure to be an improvement in the chances for the economy unless widespread unemployment is prevalent.

It would be impossible in a paper of limited scope such as this one to explore or even attempt to cover the literature on these intricate interrelationships. But certainly it can be said that a government with access to both morbidity and mortality statistics will be in a better position to conduct effective economic planning and to manage better the development of its economy and educational system. The one requirement that such uses of health measurement data seems to imply and that has not already been mentioned is that the morbidity statistics be accompanied by statistics on resulting disability. The extent to which illness and injury prevent people from working, keeping house, or going to school would seem to be an essential adjunct of the data if they are to be used in social and economic planning, as well as public health planning and program evaluation. Such data on numbers of days people have been kept from their usual activities because of ill health permit the planner to secure at least a crude indication of the effect on morbidity on the economy. Hence, in considering needed developmental research for measuring the health of populations, we shall include discussion of measures of disability.

The Theoretically Possible Ways of Measuring the Health of a National Population

The needed methodological research in measuring the health of populations in the developing countries can be more easily assessed if

one considers the inherently different ways that health can be measured and then the resources that are likely to be available in these countries. How can we learn about how unhealthy people are? The following are the alternatives, with a very brief commentary on the basic characteristics of each:

A. One can arrange to have a sample of the population given a standardized examination by a team of doctors, nurses, and other clinic-type staff. This is the most medically reliable method, but it is exceedingly expensive and logistically complex.

B. One can have trained interviewers visit a sample of the people in their homes and ask them a standard set of questions about their health. This procedure can reveal some health problems that have never received medical attention, but for such conditions the family is very unlikely to know the exact nature of the disease or injury problem, so most data on untreated illness are reported only in the form of symptoms.

C. One can obtain reports from doctors, nurses, or other trained health personnel about the illnesses they observe among the patients who solicit their assistance. This method can be carried out in the form of a special survey and cover all illnesses and injuries, or it can cover only certain diseases. It includes the statistics of cases of diseases where the treating staff are required to report by law. In either case, however, it is dependent upon the availability of trained health personnel to provide care and upon the extent to which people seek them out for help. The same method can be extended, or limited, to cases treated in hospitals.

D. One can collect information about the numbers and causes of deaths occurring in the population. This limits the measurement of health problems to those having a fatal outcome, and the cause of death depends for its reliability on whether the deceased had medical attention at the time of the fatal illness or injury. Nevertheless, use of the death record has the advantage that the recording, or registration, of the facts of death is required by society for purposes other than measurement of the population's health.

These four basic methods or variations on them, either alone or in combination, produce virtually all the statistics on the health of

populations that exist in developing as well as in industrialized nations.

The Present Practical Limitations in LDCs

The four basic methods can now be considered in relation to the kinds of practical limitations one is likely to find in developing countries.

Method A, the health examination, is undoubtedly the most expensive and difficult to organize and operate. To reach a representative sample of the population with a standardized examination requires trained medical teams and, often, elaborate clinical equipment. The examination must be brought to people reasonably close to their residence, or the people must travel to the site of the examination. It is probably the least practical of the general methods for any country that is short of resources and trained personnel. But saying this should not be taken to mean that health examinations have not been used. Columbia conducted an examination-type sample survey in 1964-1967 that was a part of a larger study of needed health laborpower. This survey borrowed to some extent from the experience of the Health Examination Survey conducted in the United States since 1959.1/

We have excluded discussion of methods limited to a single disease or group of diseases, but it is worth mentioning that clinical examinations of population samples have been widely used for measuring the prevalence of certain diseases known to be of particular importance in the country doing the survey. These have not usually been national samples, however, but samples within a district.

The survey based on examination of representative samples of the population will not be discussed further in this paper, but it should be borne in mind that this is the only method that is capable of detecting asymptomatic disease in the population. It is also the only method that can provide prevalence rates for clinically defined diseases, for example, hypertension or specific avitaminoses.

Method B, the health interview, is also complicated and expensive but far less so than the examination. The representative sample usually consists of the persons residing within a scientifically selected set of small areas. Into these areas must be sent persons trained as interviewers. (If there are language problems, they must be accompanied by competent interpreters.) The interviewers do not have to have had medical, paramedical, or nursing training, but they must be people with sufficient education to read maps and instruction books, follow instructions, and write legibly. The interviewers are usually organized into crews, each covering a particular district, and each crew is headed by an interviewing supervisor. There must, of course, be a cental office manager and statistical analysts. Though industrialized countries rely heavily on computers nowadays for converting the interview results into

meaningful statistics, there is not a single part of the process that cannot be done by hand if need be.

There is, in the above, no requirement that cannot be met in a developing country if it wishes to pay for the kind of information that will be provided. A possible exception is the design of an efficient sample and the availability of reliable maps showing towns, villages, and roads. (The sample design expertise can usually be borrowed from another government or international agency.)

The major question about Method B is whether the results are worth the expenditure of resources. The limitations of the method should be well understood, along with its advantages. Without going into great detail, the advantages are the following:

1. As stated above, the health interview does not require expensive equipment or scarce categories of skilled individuals.

2. It provides, as part of the interview, the necessary denominator data for the computation of incidence and prevalence rates, and demographic or socioeconomic subgroups can be readily identified. If the sampling has been carefully performed, it can even be useful as a basis for estimation of the nation's population.

3. Other types of health data, such as the utilization of various health care practitioners and facilities and habits of behavior affecting health, can be collected at the same time the morbidity data are gathered.

4. It measures health in the way that most people are concerned about it: their aches, pains, or loss of vision, hearing, or mobility that affect their ability to carry on their normal activities or earn their living. Losses to the national economy owing to illness and injury and the resulting disability can be estimated from interview results more satisfactorily than from any other type of health data.

5. Illness or injury that has not been treated will be reported in the interview, but, naturally, the nature of the disease from which a person is suffering will usually not be known if it has never been diagnosed.

Despite these advantages the results of interviews devoted to the health problems of people visited in their own homes have shortcomings as a sources of data on morbidity:

1. The first is that asymptomatic disease is not reported in the interview, and for many widespread conditions of a chronic nature this can be a serious gap. The most obvious example, perhaps, is the group of diseases related to undernutrition or malnutrition. Most of these are asymptomatic until very late stages. The same is true of a number of parasitic diseases prevalent in tropical and subtropical countries.

2. Another shortcoming is that, in countries where access to medical care is limited, the description of the health problem of a family member provided in the interview is difficult to use for national planning and program evaluation purposes. This is because the description does not pinpoint the nature of the health problem. In the industrialized countries, where doctors and nurses are more readily available, it is expected that the respondent will simply be passing on to the interviewer what the physician has told the family. Hence, a lot of data can be classifed by diagnosis in some detail. The same cannot be said, of course, of much of the data that is reported in a developing country.

3. A more subtle problem is that the perception of ill health which triggers the reporting in an interview is subject to variation associated with cultural norms. Blood pressure or the red blood cell count can be measured without regard to culture by clinical means, but whether a person reports he/she has trouble from dizziness, headaches, or constant tiredness depends greatly upon the cultural norms in the population of which he/she is a member. This variation hampers the comparison of health measures between districts within the country and between countries.

Despite these disadvantages the health interview has, in our view, great possibilities for the measurement of morbidity in developing countries. Ways that the usual survey might be improved through research for use in LDCs will be discussed in a later section of this paper.

Method C -- reporting by doctors, nurses, clinics, and hospitals of illnesses they observe in the course of providing care -- is the least expensive of the methods of measuring morbidity, but it is also likely to be the least satisfactory to LDCs. The problem is, of course, that the reporting of disease is entirely dependent upon the adequacy of the health care resources. No uncared-for illness can get into the statistics, and the amount of disease and injury included tends to be positively correlated with the availability of doctors, clinics, and hospitals to care for the problems. In industrialized countries such data are

collected but they are not usually relied upon to measure the health of the population.* They are used, instead, for monitoring the operations of the health care system. In developing countries the emphasis in the measurement of health has to be on the extent to which health care needs are being met, and, for this purpose, the cases coming to medical attention cannot, by themselves, provide answers.

Finally, we have Method D, the collection of information about the numbers and causes of death. This is the first method that was used by the now industrialized nations to produce national figures on disease problems, trends, and regional comparisons. The registration of births, deaths, and marriages emerged as a governmental function from records originally kept, principally, by the churches to keep track of their members' families. Eventually the records came to have legal and health purposes as well, and, starting about two centuries ago, the registration and the production of statistics from the records was taken over by the civil government.

In present-day developing countries the registration of vital events — birth, marriage, and death — is in varying stages of evolution, but it is safe to say that, because of the enormous importance of the statistical and legal information they provide, every government has the complete recording of these events as a goal. Hence, some sort of partial registration of births and deaths exists in every country. In those countries, e.g. India, where the excess of births over deaths threatens to hamper economic development and depress per capita income, the measurement of the birth and death rates to provide statistics on the growth of the population between censuses is given very high priority in the plans of government.

Nevertheless, the worldwide statistics compiled by the United Nations and the World Health Organization reveal that in many countries even the numbers of deaths occurring each year are very incompletely counted. Registration in the urban areas is probably considerably better than in rural areas.

To serve the kinds of purposes mentioned in the above section, "Customary Uses of Statistical Health Measures at the National Level," the deaths must not only be registered reasonably completely (let us say 85 percent or better) but must be classified by cause of death in some

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* For certain kinds of health data, however, Method C is, nevertheless, the most dependable. Examples include: advance warning of epidemics of communicable diseases where marked change in cases reported in a few weeks will show up in the cases reported by physicians, and cancer statistics where the incidence of cases diagnosed in medical facilities provides the only practical possibility for securing the medical details needed for cancer control.

way. Without at least the age, sex, and cause of death, the data cannot reliably be used to identify health problems or to trace the degree of success in dealing with them.

Cause-of-death data are often not available in countries where the numbers of deaths by age and sex are reasonably completely counted. Even when the cause of death is recorded, it is an expensive matter to assign the numerical codes that permit the production of cause-of-death statistics.* Where the causes are available in only part of a country, a problem may be the availability of appropriate population denominators for the calculation of death rates.

Statistics of mortality, however, are a fundamental source of information on the health of populations. Much attention will be given in developing countries to the improvement of registration of vital events and the assignment of cause of death. Hence, research to find methods of using this source, even during the period when the eventual system is far from its eventual goals, must be undertaken. As will be noted below, the World Health Organization's health statistics program has recognized this need.

Approach to "Needed Research" in the Sections to Follow

In the remainder of this paper we shall be addressing what we believe to be the major needs for research before satisfactory measures of health can be obtained to accompany and assist the social and economic development of LDCs. It is taken as a premise that the presently available statistics in many countries of the world are not reliable or are not appropriate measures of the health of the national populations. It is also a premise that the resources for gathering better data are limited in terms of both money and trained staff.

The problem, then, is to find methods that are not too costly and not too demanding of scarce skills. These methods will not be thought of as permanent answers to the needs for measures of health. With economic and educational development, it is assumed, more comprehensive and sophisticated systems will become practical. But such changes may be decades away, and there are needs that must be met soon -- during the process of development.

We shall focus entirely on the use of interview-type sample surveys

* Preston, Keyfitz, and Schoen[2] include only 48 nations in their new volume on causes of death. They point out that the production of cause-of-death statistics is of more recent origin than statistics on general mortality. Even Sweden did not collect cause-of-death data for the entire nation until 1911. In the United States, it was not until 1933 that the entire country was included in the death registration area, although fairly complete coverage was achieved by 1920.

and on the development of cause-of-death statistics in the belief that these hold the best hope for early results that will be useful to national planners.

Mortality Research

Registration Improvement: Testing of Completeness

There is no single group of social statistics more critical to planning than statistics on the size, growth, and characteristics of the populations. Mortality statistics measure a critical component of population growth but the statistics also form the basis for what can be a valuable indicator of health problems. The first need of the registration system for deaths is that the registration meet a standard of completeness. We have, quite arbitrarily, set the standard at 85 percent on a nationwide basis. At that level of completeness, or above, the data can begin to be useful; below that level all the emphasis should be on improving the registration.

There are many obstacles that must be overcome in attempting to improve the registration of deaths, but two, in particular, have proved baffling.

First, the responsibility for registration in many national governments is located in departments with very little statistical expertise and without a strong incentive to bring about more complete registration. In a recent analysis by Powell[3] of the location of registration responsibility in 174 countries it is reported that 105 have a national registration service; 50 have none; and in 19 the status is unknown. In 84 of the 124 countries where the location of registration responsibility is known, that location is in the ministry of the interior and/or the ministry of justice. (Forty-seven of the 84 have a central registration service; in the remainder it is decentralized.)

The compilation of vital statistics, on the other hand, is in 80 percent of the instances the responsibility of the central statistical office which is usually in the planning ministry, the finance ministry, or the prime minister's office. In only 11 countries is there a national registration service located in the central statistical office, and in another 12 it is known that the general register office also has the responsibility for the compilation of the vital statistics. Both registration and vital statistics are centered in the health department in ten additional countries. So, in at least these 33 there is some input by statisticians to the improvement of registration. (The author notes, however, that arrangements for vital statistics are unknown in 20 countries that do have a central registration office; these, too, may have a link between the statistician and the registrar.)

Hence, an administration problem to be overcome that should be susceptible to a research approach concerns how best to organize the responsibility for registration in a developing country to bring about

more rapid improvement in the completeness of registration. Certainly, the involvement of the central statistical office or another office staffed with knowledgeable statisticians would seem to be a prerequisite for improvement because the legal uses of the records made by ministries of justice and the interior do not demand the kinds of data quality that are required for statistical purposes. This hypothesis could be tested be extending the kind of research Powell has done into data on the historical development of registration in LDCs. In fact, a straightford, impartial historical account of the efforts to develop improved registration in a dozen LDCs of varied characteristics would be enormously valuable.

The second obstacle in attempting to improve the registration of deaths is the difficulty in measuring registration completeness. This is a complex subject on which a great deal has been written.[4, 5, 6] It is only possible here to summarize briefly the methodological approaches.

There are two general lines of attack. Bot have been used principally to obtain the best possible estimates of the birth and death rates in countries where the registration system alone is not reliable. Obviously, however, such methods can also be used to estimate the completeness of death registration and, if used periodically, to determine whether the registration is improving.

One line of attack has been to use survey methods and registration, jointly, in sample areas of the country. Periodic household surveys in the sample areas are used to inquire about births and deaths in the families at the same time that births and deaths of persons residing in those areas are being recorded through the civil registration system. The results of the dual systems are matched and classified into strata according to characteristics of the households. The objective is to have matched data for groups of families that are as much alike as possible. The matching produces three cells of a 2x2 table of the following type, using deaths as the example.

	In Registration System	Not in Registration System	Total
In Sample Survey	D_{11}	D_{12}	$D_{11} + D_{12}$
Not in Sample Survey	D_{21}	X	
Total	$D_{11} + D_{21}$		D (Total)

Since the table consists of data for a reasonably homogeneous group of families, it is possible to assume that the classifications are independent. This permits estimating X from the values of D_{11}, D_{12}, and D_{21} obtained by the matching. This, in turn, makes it possible to estimate D (Total). The completeness of death registration is, of course:

$$\frac{D_{11} + D_{21}}{D \text{ (Total)}}$$

There are variants of the survey design and of the registration system used, but the scheme described here underlies the method. It was first proposed by Chandra Sekar and Deming.[7]

The other approach depends upon actuarial analysis of successive censuses of the country. By examining detailed age distributions of the population in successive censuses and making certain assumptions, it is possible to determine what pattern of mortality rates would have produced the observed distributions. The mortality rates can be translated into estimated numbers of deaths which can then be compared with the registered deaths. (A number of demographers have written on this method and variations of it, but Brass and Coale[5, 8] are the names now most closely associated with it.)

Since a great deal of effort and money have already been devoted to methodological research on measurement of the birth and death rates in LDCs, it is not necessary to label this as an areas of "needed developmental research." Nevertheless, it is still a fact that most LDCs have very incomplete registration of deaths. Quoting Shryock and Siegal: 6, p. 391

> The United Nations finds death registration to be substantially incomplete for most countries of the world, including nearly all of those considered underdeveloped. According to an analysis of data which the United Nations carried out for 1951-55, only about 33 percent of the world's deaths were being registered, the percentage varying regionally from 7 percent for East Asia to 100 percent in North America and England.

The situation has probably improved only a little since that time. Yet every country badly needs the kinds of statistics that a good registration system can supply. In efforts to improve registration, studies of the degree of completeness must be conducted. The problem, therefore, is not so much one of developing new methodology, but of applying more widely that which now exists and stimulating greater effort on the part of those responsible for registration. Health planning, as well as planning for economic development, will be hampered until death registration is raised to at least 85 percent completeness.

Registration Improvement: The Use of Sampling

It may be that satisfactorily complete registration of births and deaths will not come about until the country has arrived at a higher stage of indsutrialization and per capita wealth. In other words, the achievement of complete registration throughout the country, which could yield such valuable data for planning socioeconomic development, might not occur until socioeconomic development has come about. The establishment of a high quality registration system requires a heavy commitment of people and resources -- a commitment the country may feel unable to make.

If that is the case, consideration should be given to developing registration in a sample of the geographic areas of the country.[9] Intensive efforts to register births and deaths in a sample of areas permits the concentration of resources in a small fraction of the country's land area and population, thus reducing costs to manageable levels. Yet inflation of the results from the sample areas will provide unbiased estimates for the country as a whole, and the range of possible error, or confidence limits, resulting from the sampling can be stated, provided there is probability sampling. That is, areas must be selected in such a way that the probability of selection of any area is known and is not zero. Drawing the sample efficiently and setting down the estimation equations and the equations for computing the confidence limits require the assistance of a trained sampling statistician. But if that set of skills is not available within an LDC, it can usually be borrowed.

The establishment of national vital statistics based on a probability sample of areas in which complete registration is undertaken is now underway in about eight different countries.[6] (India appears to be the furthest advanced. Statistics for that country based on the sample have been published since the late 1960s.)

Research and demonstration should be launched on area sample designs that will permit a country to start on a very small scale, perhaps not more than a half dozen areas, and successively increase the coverage of the sample until it completely blankets the country. The aim should be to have at any one time a representative registration of births and deaths, with modules of the sample that can be added as resources permit. Each time an additional sample is added, the precision of the estimates is improved, until eventually the finite universe sampling error is reduced to zero.

In establishing a sample registration area it is important to keep in mind that sampling error is not the only source of error in the data. Poorly trained registrars or shortcomings of the registration within the sample areas can introduce non-sampling error. Despite the best of sampling designs, under-registration or inaccurate recording of the circumstances of the birth or death will destroy the usefulness of the data.

Temporary Alternatives to Medical Certification of Cause of Death

As noted earlier, there is a practical limitation of the usefulness of mortality statistics for measuring health in LDCs. The use of such statistics to identify health problems and to indicate unmet needs for care depends upon knowing the cause of death, information which in industrialized countries is provided in most instances by the attending physician or medical examiner. What can be done when the great majority of deaths occur to people who were not being cared for by a physician at the time of death?

In rural areas of India this problem is being solved by sending paramedical personnel from the Primary Health Centres into the homes of deceased persons to gather information from relatives by means of a questionnaire about symptoms, anatomical sites and duration of complaints of the deceased person's final illness. The scheme was introduced on an experimental basis in 1965 by the Office of the Registrar General. A complete field manual was later drawn up and, according to the latest information available, is operating in 570 primary health centres selected to be representative of the rural areas.[10]

A similar approach is being studied in a project being conducted by the School of Public Health in Zagreb, Yugoslavia. (This project is being funded through the P.L. 480 program and is the result of an agreement negotiated between the United States and Yugoslavian governments. The U.S. Government is represented by the National Center for Health Statistics.) The objectives may be quoted as follows:[11]

1. To develop a method of obtaining from the informant at time of death registration, pertinent information on causes of death for all age groups, which can be used as a basis for producing useful statistics where death occurs without medical certification;

2. To develop a classification of causes of death suitable for tabulating causes of death without medical certification which can be merged with data on causes of death with medical certification;

3. To determine the number of non-registered cases of death in the local registration areas included in the study;

4. To conduct a study in a specific area using the methodology developed in the first stage of the study to test the practicability of the procedures, and to ascertain the effects of the method on the total statistics of causes of death for the area.

Yugoslavia was considered an appropriate site for such a study since 31 percent of the 1969 deaths for the whole of the country had a

cause of death specified only by a lay person. This percentage was as high as 60 percent in one district at the time the study was initiated.

The field trial was to be conducted in an area with about 10,000 deaths a year of which about a third would be expected to be without medical certification of cause of death. Unfortunately, the project, set underway in about 1972, has lagged badly and no report of results is yet available. The data on cause of death were to have been obtained in a standardized interview with a member of the household of the deceased person. The interview was to be employed initially in samples of households experiencing deaths that had and had not been medically certified. Thus, results could be compared between the samples and also with the causes supplied by the attending physician in that part of the sample.

One recommendation emerging from the research is that an effort must be made to get behind the symptoms that accompany the decedent's final days, or hours, of life. It is not particularly helpful to know, for example, that a person, in his/her death throes, was "struggling for breath."

It is our view, however, that research of this nature, if vigorously pressed forward, can within a few years produce results that can be extremely helpful to LDCs in measuring health problems. There is not a need, in our opinion, to spend a number of years developing an internationally agreed-upon classification of symptoms, though that would eventually be desirable, nor is it necessary to attempt to relate the symptoms on a one-to-one basis with categories of the International Classification of Diseases. The immediate objective should be to classify the symptoms according to the likely problems of health within the country and to begin to collect data on all deaths, or a representative sample of the registered deaths, with both the medical certification, if any, and the family member's report of symptoms during the illness preceding death. The emphasis, at first, should be on region-to-region comparability <u>within</u> the country and on comparability over time.

Of course, there is also need, as indicated above, for a vigorous program of methodological research on lay reporting of causes of death before the method can be recommended to LDCs generally.

In concluding this section we would like to quote from a paper by a physician who has had first-hand experience with problems of health in a developing country, Dr. J. J. Leveuf, Technical Advisor to the Directorate General of Health in Mali. The paper is entitled, "Study of Perinatal and General Morbidity and Mortality Statistics in Developing Countries," and the opinion expressed is one with which we would heartily agree:[12]

> It would seem indeed that in these regions (rural areas of tropical Africa) the only way of registering deaths consists in entrusting this task to an administrative or health

> official with the mission of making a general tour of the villages in his district every month and interrogating the person responsible for informing him on the deaths that have occurred and the circumstances surrounding them. If need be, he could obtain additional information from the family or near relations of the deceased persons. The information collected by him would be entered in a register of deaths and would be tabulated monthly and/or annually.

We do not know whether Leveuf is suggesting an independent registration of deaths (where the legal responsibility is in a different governmental department) or whether the Directorate of Health has this responsibility in the nations of tropical Africa. If the former, there might be administrative obstacles, but the idea that health officials should regularly circulate among the local "registrars" and see to it that the deaths are registered, including particularly those of young infants whose deaths are most likely to go unreported, and that the circumstances of death have been secured from family members -- this idea, we believe is the right one for the world's developing countries.

New Methods of Analysis, With Special Attention to Preventable Deaths

It is clear that, when a large proportion of deaths cannot be assigned to a category of disease or injury according to the International Classification of Diseases, it is necessary to think of analyzing the data in ways that are totally different from those traditionally used in the industrialized countries. The basis of this analysis should not be the disease of type of injury responsible but rather (1) the body system principally affected (including, of course, the entire body in the case of generalized infections); (2) a broad classification of symptoms with such categories as fevers, wasting away without fevers, injuries, etc.; and (3) whether the death appears to have been preventable. By "preventable" we mean that, within the bounds of present medical knowledge and without limitations of resources in facilities, equipment, or manpower, the death, not necessarily the onset of disease, could have been prevented.

Can symptomatic information provided by a lay respondent be analyzed in that way? It is obvious that in terms of individual deaths conclusions about whether the death was or was not preventable would be wrong almost as often as they were right. In using the data for statistical purposes, however, it is not necessary that such decisions be correct in a large proportion of cases. It is only necessary that the aggregated information, that is, the statistics, carry a correct message -- e.g., that the death rate per 1,000 population for preventable digestive system deaths is increasing, or decreasing; or that this death rate is much higher in Region A of the country than it

is in Regions B through F.* Such conclusions may be correct even though the decisions regarding individual deaths may frequently be wrong.

Why should we attempt to classify deaths according to whether or not they could have been prevented? It is gradually coming to be realized in the industrialized countries that mortality statistics, even classified by cause of death, are extremely insensitive measures of the population's health. This is owing to the fact that large proportions of the deaths result from causes which either cannot be prevented at all by the utmost application of modern medical knowledge or cannot be prevented at the ages at which they occur. Hence, despite all of the best efforts of health planning and programs of action and the increasing availability of facilities and manpower, the death rates refuse to decline. They are heavily weighted by deaths no one knows how to prevent or deaths which would require much effort to prevent even if the way were known (for example, a death from stroke in a person 85 years old). By eliminating such deaths from the indices of mortality, mortality statistics become much more useful measures of the health of communities. They more closely reflect success, of lack thereof, in the goals the public health program is attempting to achieve.

This is not likely to be such an important problem, of course, in LDCs because, we assume, the typical pattern would be to have much lower proportions of non-preventable deaths. If 75 percent of the deaths either occur before the age of 25 or are due to communicable diseases, for example, then the mortality indices will be sensitive to the degree of achievement of public health goals even if the remaining deaths are not preventable. Nevertheless, the analysis should be designed to focus sharply on these measures that will reflect the goals of the public health effort, even if it means excluding some of the data. In the LDCs these goals, we believe, will most often be to prevent, first, unnecessary mortality and, second, avoidable disability.

What is recommended here is a flexible, objective-oriented approach to the analysis of mortality in LDCs, instead of profitless imitation of the traditional analyses published year after year by the industrialized countries. The latter have outlived their usefulness and are, we hope, in the process of change.

Another reason for advocating an analysis keyed to body systems, symptom types, and preventability, though not neglecting the demographic

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* This paper does not attempt to deal with the questions of the availability of population denominators for death rates in LDCs. It is assumed that very little socioeconomic progress can be made without periodic censuses and that such data are, therefore, almost a sine qua non for health planning as well. In the absence of population figures, however, some limited conclusions can be drawn from proportions of deaths in each category, instead of death rates.

characteristics, lies in the strong belief that statistics of deaths and their causes are one of the few available sources of information on population health that are within the LDCs' practical resources. Since these deaths will for many years be registered without a medical certification of the cause in a large proporation of cases, it is necessary to find ways of making use of what is available, instead of awaiting the day when the data are as complete and medically reliable as one would like. (Actually, this advice applies equally well in the wealthiest countries of the world, where, because of their admitted shortcomings, mortality statistics are frequently criticized and shunned by the perfectionists.)

Morbidity Research

Background of the Unmet Health Care Needs Symptom Questionnaire

The emphasis in recommended research in the area of morbidity measures will be on the use of household sample surveys to gather data on symptoms of illness and disability (the latter being defined as an inability, resulting from ill health, to carry on the activities normal for a person of a given age and sex). Of particular value to LDCs, we believe, is the research that has been conducted on standard symptoms lists used to provide indicators of unmet needs for health care.

The basic idea of the unmet health care needs symptom questionnaire is very simple. First, physicians are asked to agree on a set of symptoms, ranging from all the body systems and including generalized symptoms such that the existence of any one symptom would, under ideal conditions, warrant seeking medical attention and receiving treatment or, at least, a thorough examination.

Second, the list of symptoms is expressed in the everyday language of the people. If there are language problems, the equivalents in each language or culture must be found.

Third, the popularized list of symptoms is incorporated in a household questionnaire (which may, of course, include questions on other health matters and will certainly include questions on the age, sex, and other characteristics of the members of the household). The object of the symptoms list in the questionnaire is to determine for each family member whether he/she has had experience with that symptom during a defined period of the past, usually the past three months.

Fourth, each time there is a positive response regarding a symptom, a follow-up question is asked to determine whether any help or advice has been sought and, if so, from what source.

The proportion of people having one or more symptoms that has gone untreated is an index of the amount of unmet need for health care in the

sample of households included in the survey. The symptoms can also be grouped by body system or other characteristics of the symptom to define further the nature of the unmet needs.

The particular advantage of such a questionnaire for LDCs is the simplicity of the survey. The instructions are easy to master so an interviewer who can read, write, and understand simple maps can be trained to do the field work. Analysis is also relatively simple. Yet the kind of results produced seem directly relevant to the needs of health authorities and the uses mentioned in the above section on "Customary Uses of Statistical Health Measures at the National Level."

To our knowledge, the first development and use of such a questionnaire was by the Bureau of Agriculture Economics of the U.S. Department of Agriculture. Beginning in 1944, the Bureau began to experiment with such a set of questions for measuring health care needs of farm families. At that time the questions were part of a general standard-of-living questionnaire including sections on food, clothing, housing, transportation, and eduction.[13, 14]

Subsequently, the questionnaire was tested in two stages in rural areas of seven different states. The second test included over 40 symptoms, but this number was later reduced to 22, those proving most ambiguous having been deleted or changed. During this testing, the results were regularly reviewed by physicians who helped in the refinement of the list.

In 1946, a sample of families in three counties in Michigan was interviewed using the revised list of symptoms, and a subsample was asked to come to a clinic for an examination soon after the interview. The examination was designed to test the validity of the symptoms questionnaire as to the finding of an unmet need for medical care. In 80 percent of the 153 individuals examined, the finding of a need for medical attention or no need for medical attention was confirmed. Six percent were false positives (that is, the replies to questionnaires indicated a need for medical attention, but the exam failed to confirm it), and 14 percent were false negatives. The net measures were 46 percent needing medical attention according to the interview and 54 percent according to the examination. This degree of validity was considered highly satisfactory, especially since a substantial part of the error arose from only two body systems, the teeth and the eyes.

In 1948, the symptoms approach was included in a statewide survey of Michigan (exclusive of Wayne County),[15] and extensive tables of results were published. By this time the list of symptoms had been further revised and included 27 items.

The next application of the general technique of symptoms reporting of which we are aware was made beginning in 1955 in a population of

two Eskimo communities on St. Lawrence Island in the northern Bering Sea region. This application was initiated by a doctor of veterinary medicine, Karl R. Reinhard, who at that time was with the U.S. Public Health Service's Arctic Health Research Center in Anchorage, Alaska.* The objective in this instance was somewhat different. There was no question of creating an index of unmet medical care needs; health services in the communities, which had no resident medical or even paramedical people, were provided by an itinerant public health nurse and school teachers. The problem was to provide some kind of continuing health surveillance that would yield data for planning and evaluating health services for geographically and culturally isolated communities. The solution, nevertheless, was not basically different.

A list of symptoms was developed based on the knowledge of people who had dealt with these communities. The list was first expressed in everyday English and then, with great care, translated into the Eskimo equivalents. The actual collection of data, however, differed from the earlier application in that it involved no trained interviewers from outside the community. Instead, members of the community were enlisted to keep prospective records of the occurrence of the symptoms, the names and ages of the individuals affected, the weekly period of the report, and the source of treatment, if any. The illnesses were described in narrative form but, essentially, in a simplified language agreed upon in advance. Births and deaths were also recorded. Reports were mailed to Anchorage each week and periodic visits were made to the island to feed back the statistical information, discuss reporting problems, and incorporate improvements in the system.[16]

Reinhard continued and extended this work after moving to the Health Programs Systems Center of the Indian Health Service. The list of symptoms was organized into six Symptom Description Headings, including one for Mental-Social-Behavioral, and to these were added sets of modifiers such as the circumstances of occurrence, the extent or severity of the symptom, the anatomic location, and causes of injuries. He also studied the interrelationships of symptoms and the usefulness of data of this type for other settings.

Summarizing what is, for the purposes of this paper, the most significant result of his continuing work is a quotation from a paper by Reinhard:[17]

> An operable, reliable illness reporting system can be based on the participation of the average citizen, as long as he or she and the health professional have established an effective means of communication.

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* Dr. Reinhard was apparently unaware of the earlier Agriculture Department-supported work; at least, there is no reference to it in his papers.

It is surprising to find how few words are needed to maintain communication about common illness. Pragmatic analysis of the study cited previously showed that 343 descriptor-modifier combinations were used in describing the illnesses occurring over a 65-week period of time, among 287 persons, of all ages. But only 38 of those descriptor-modifier combinations were used ten times or more during the entire period.

Current Research on Symptom Reporting

In recent years, WHO has evinced an increasing interest in what is described as "lay reporting of morbidity and mortality." In March, 1973, a consultation on the subject was held in Geneva at which reports were heard from several countries.[18*] Most had to do with the lay reporting of causes of death (those from India, Yugoslavia, Mali. and Senigal) but two, those from United States and Thailand, dealt with morbidity. The U.S. report was mentioned in the previous section. Thailand reported on a system being tried there, first, among the outpatients of an urban hospital and two health centers; second, in two rural health centers; and, third, by "communicators" (volunteers trained to administer the basic questionnaires) in rural villages, apparently by visiting the families in their homes.[19] In the Thailand trials, as in the Eskimo population, the emphasis seemed to be on recording complexes of symptoms from which particular disease conditions could be inferred, instead of the simpler objective of ascertaining number of persons in need of medical attention.

In November, 1976, the WHO Southeast Asia Region assembled a Working Group on Lay Reporting of Morbidity and Mortality. A number of countries of that region reported on their experience, but we have not yet seen these papers reproduced.[20] The subject of lay reporting of morbidity and mortality also came up at the International Conference on the Ninth Revision of the International Classification of Diseases in 1975, but there the principal aspect discussed was systems of classification.

There may well be a number of countries now experimenting with the use of questionnaires in which health is measured by the recording of symptoms. Certainly, as LDCs become aware of the critical need for establishing health surveillance programs for early warning of new health problems and for input to health planning, the interest in systematizing the collection of data on symptoms of illness and injury can be expected to increase. But the practical field trials being conducted are scattered all over the world, and it is extremely difficult to keep track of what is going on.

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* There had been a previous meeting on a similar subject in 1971; papers from that meeting were not available to the author at the time this paper was written.

Standardization for International Comparison

It seems that a good deal of the discussion of systems of morbidity reporting for use in countries with very little organized medical care revolves around the question of the relationship of the symptoms, or symptoms plus modifiers, to categories of the International Classification of Diseases (ICD). Furthermore, there is already concern about international comparison.

In our view the time has not yet come to be wrestling with either of these questions. The validity and usefulness of the data do not depend upon being able to draw conclusions about the particular disease the reported symptoms imply. What matters is whether the symptom or symptom-modifier categories are unambiguous, understood by family members, accurately recorded by the interviewer or other reporter, and properly reflected in the statistics. It is also most important that the set of symptoms about which questions are asked meet three criteria:

1. Relevance to the likely health problems of the country.

2. Of sufficient gravity that they require, in the opinion of experts, medical attention, at least to the extent of determining what the disease problem is.

3. Expression, in the actual questions asked, in terms of the everyday vocabulary of the people of the area and in as objective language as can possible be devised.

For the time being the objective should be to make the results as useful as possible to the health authorities of the LDC. Perhaps ten years from now it would be appropriate to begin to think about introducing international comparability.

A Program of Testing and Validation

In line with the principles set forth in the previous section, the validity testing needed before the symptoms recording system is ready for widespread use in LDCs can be described. It should be designed to answer the following set of questions.

1. How clear is the understanding of the responding family member of the terms used in describing each symptom? If the same person is interviewed a second time a week later, are the responses the same, making allowance for the elapsed time?

2. How much difference does the recall period (the previous three months, the previous month, or the previous two weeks) make in the relative frequency of new symptoms reported, making allowance for the length of the interval?

3. If different interviewers visit subsamples of the same population, how much difference is found between the results in the subsamples? (Such differences can be assumed to result from variation among interviewers in how they perform their tasks.)

4. If doctors examine samples of the members of the same families that were interviewed, do the doctors confirm the existence of the same symptoms that were reported? (It is assumed that the doctors have not had access to the interview results but conduct their own querying as well as administering an examination.) Do the doctors confirm the need for medical care for the symptoms reported? How often and for what conditions does the doctor see a need for care or further testing that would not have been assumed on the basis of the interview results alone?

5. If data for the population of an area are gathered for several years, what changes emerge? If sharp increases are found for particular sets of symptoms, does intensive epidemiological evaluation confirm the existence of a new health program there?

6. How do the health authorities of the country, and particularly those responsible for health planning, react to the existence of the new statistics? Do they find they can use them in their work? If not, why not? (They should certainly have been involved in the planning of the data collection system, but the test of usefulness should be based upon whether the statistics are consulted in relation to new health issues that arise.)

It would be desirable, if possible, that a data collection system for symptoms (including symptom modifiers of the type developed by Reinhard) be experimented with in several countries. There should also be a forum, presumably provided by WHO, for exchanging information among those carrying out the research, as well as among countries which have had experience in collecting this type of morbidity data.

One very practical issue about which there may be some disagreement but about which we wish to express an opinion pertains to the manner in which data are actually collected in the field. Reinhard used reporters from the community who volunteered for the task of recording the symptoms and related items, and the data were sent to the headquarters in mailed reports. Periodic visits were made to the communities to keep the reporting on track. This arrangement had many advantages because of the deep involvement of the community leaders and the opportunity for feedback of information. The community members felt themselves to be a part of the

project. It also saved a great deal of travel money, as compared with the use of itinerant interviewers who would have had to travel significant distances at heavy costs.

It may be that in areas where travel is especially difficult this is the only alternative worth considering, and it is certainly worth further experimentation in areas other than Alaska. But the system has one very serious disadvantage, so serious, in fact, that, if it is possible, trained interviewers who travel at least within one district should be used. There has been a great deal of research indicating that despite careful training, reporters or interviewers collecting information on subjects in the health and social areas differ from one another in the way they record the information needed for the statistics. If those reporters are volunteers, living in the community with only infrequent contacts with those who designed the system and will analyze the results, there are bound to be idiosyncrasies associated with the data for the "cluster" of individuals covered by one reporter. If that "cluster" consists of persons residing in a small geographic area, the idiosyncrasy introduced by the reporter is confounded with the inherent characteristics of that group of people. Interpretation becomes very difficult.

This measurement error problem may be minimized either by making the "cluster" as small as possible (a single family, perhaps) or by having each reporter or interviewer cover a subsample of the entire population. Both of these extremes are generally impractical (except in mail surveys), and the compromise, when the information is to be recorded from answers to questions in a face-to-face interview, is to have the areas of interviewers' assignments overlap as much as possible. Overlap can only be arranged if the interviewers' work is assigned from a field office of headquarters. The supervision of interviewing from one or more field offices also permits ongoing quality control operations, such as rechecking a sample of each interviewer's work.

It is only by means such as these that the quality of data collected by asking questions in households can be assured. Nevertheless, the feedback of results to those who supplied the information (in the form of statistics, of course, so that family privacy can be maintained) is very much to be encouraged and will help to insure the continued assistance by the communities and their leaders.

Other Possibilities in the Morbidity Area, With Particular Reference to Surveys of Disability

A problem with surveys based wholly on symptoms is that it is difficult to judge the seriousness of the health problems revealed. One way of sorting out the problems worthy of attention is the method used in the early studies by the Bureau of Agriculture Economics, cited earlier. That is to have the list of symptoms reviewed by physicians to eliminate all those that would not, of themselves, require medical attention.

This is certainly a desirable step, and the review should take into account disease problems that are suspected or known to be particularly prevalent in the country. (Hence, the results may differ from country to country, but international comparability is not, as we have said, a prime objective at this stage.)

Another approach to the matter of classifying symptoms by their gravity is to add after each positive response a question about the extent to which the symptom has interfered with the daily activities that are usual for a person of that age and sex. (The question wording may have to be somewhat different depending upon the age and sex of the individual reported to have a symptom.)

We shall not attempt here to go into the actual wording of such questions, but will add a word of caution. The recommendtion to use lists of symptoms in interviews for sample surveys in LDCs is based on two features of the method: (1) their apparent suitability to the health measurement problem in countries in which the people have very little access to medical care; and (2) their simplicity. They have the virtue of requiring a minimum of training in the actual conduct of the interview. The addition of questions about interference with daily activities adds somewhat to the complexity of the interview and the training requirements. This disadvantage must be weighed against the added value of the results when the symptoms can be graded by their severity.

A wholly different strategy in the interview-type survey for the measurement of health is to build the morbidity interview entirely around questions about disability, or interference, with usual activity. This is often described as the "behavioral" approach. Instead of asking directly about departures from health, one asks about actions that may have been taken as a result of ill health. Such actions may be of two types: seeking help from someone the person believes can cure him/her; and/or restricting one's activities. It is likely that these two kinds of responses to feeling sick or sustaining an injury are common to all cultures in one form or another. It must be kept in mind, however, that the point on the continuum of discomfort at which an individual takes a particular action may differ greatly between countries and even between city dwellers and people residing in rural areas. The factors that can bring about such differences are fairly obvious. In the case of seeking help, the point at which the action is taken depends upon the availability and convenience of the help, one's psychological attitude toward ill health, whether it costs anything and, if so, how much, and whether one thinks the help will be effective. In the case of restricting usual activities, the point of action differs depending upon how seriously one believes the restricted activity will affect his/her ability to satisfy other needs, such as earning a living, preparing meals, or caring for children. Again, one's overall attitude toward ill health makes a lot of difference.

Is it God's will, the inevitable lot of humanity, or something the person; the doctor, or the government should be able to do something about?

In the Health Interview Survey, conducted as a part of the National Health Survey in the United States since 1957, it is recognized that restricted activity due to illness, particularly a day lost from work by the family breadwinner, means a different thing to the farmer and to the city office worker with paid sick leave.

Despite these known problems of interpretation, the measurement of ill health in terms of behavioral criteria is considered to have an advantage of great objectivity when compared with attempting to discern the existence and degree of ill health through such a direct question as, "Were you or any member of your family sick last week?" The reason for the preference of the behavioral approach can readily be appreciated when one considers the subjectivity of the concept of being "sick." Furthermore, classification of a nation's population in terms of its disability status has meaning both for economists and demographers.[21]

Without belaboring this point, for the use of LDCs, the direct questioning about specific symptoms, each considered by medical experts to be sufficiently serious to warrant medical attention, or, if that seems too restrictive, questions about restricted activity resulting from illness or injury, is to be preferred. With a somewhat greater commitment of resources, the two types of measurement can be combined.

In general, moreover, the use of a data collection system depending upon a corps of field workers asking standard questions or a representative sample of families is much to be favored over an attempt to conduct standard examinations or to rely on problems of health brought to the attention of health workers by the people themselves. We are speaking, of course, only of the measurement of general morbidity, not the measurement of the prevalence of a specific disease or related group of diseases or impairments, and the problem addressed is how best to gather such information in the typical LDC which must rely almost entirely on its own limited resources.

This is not to say that such means of measuring health in LDCs are already developed and ready to go. The problem of implementing such surveys in, say, a country of tropical Africa, particularly the sampling, logistical, and training problems, are many-faceted, but there is no fundamental reason to think they could not be overcome in the course of a program of trials, developmental research, and demonstration.

Conclusions

Thoughts on Implementation

As indicated in the previous section, there is no inherent reason why surveys of the type described there (in very general terms) cannot be

carried out in any LDC in the world. The same holds true for the ideas put forward in regard to improving mortality statistics -- by conducting research of the factors operating to hinder efforts to improve death registration; by establishing means to measure the completeness of death registration while moving to improve it; and by securing lay reports of causes of death and analyzing them with particular regard to their preventability. None of these is basically unfeasible.

The difficulty arises in convincing international agencies and the governments of the countries concerned of the importance of putting substantial resources into improving the data available about the basic health problems of the people. The tendency is, quite naturally, to consider that services come first and that statistics are a luxury. But the more difficult it is to come by the money to provide health services or train people, the more necessary it becomes to have some trustworthy statistics to show whether the investment is paying off.

The most familiar answer, then, is to be satisfied with data on increasing numbers of services provided and people trained. Those figures, it is said, suffice to show how successfully the money has been spent. Such an answer may temporarily serve to demonstrate effectiveness, but the critical questions remain: Are we attacking the problems that need to be attacked in health? Are the services addressed to the right populations and health problems? Have the problems been alleviated?

No matter how poor a country may be, it must consider how best to deal with the disease and public health needs of its citizens. It can do this better if it has available impartial and credible statistics on morbidity, disability, and mortality in order to rationalize its planning and measure its progress or lack of progress. Obviously, the battery of data series that have been created and proved worthwhile in the United States, for example, should not be a near-range goal for the LDCs, anymore than the capital-intensive, technology-intensive agricultural methods of the U.S. But labor-intensive and technologically simple methods <u>are</u> suitable and should be put into place, and it is methods of this type in measuring health that we have, at least superficially, attempted to treat in this paper.

Final Comment on the Relationships to Socioeconomic Development

Whether an increased per capita income, improved literacy rate, and an increased proportion of the labor force with some formal education are necessary precursors to better sanitary conditions and lowered morbidity and disability and reduction of unnecessary mortality, or whether the reverse cause and effect operates -- this is not the critical question. Almost certainly both forces operate simultaneously. The point is that economic and social development and an attack on the health problems that may be partly responsible for holding the population in poverty and ignorance must go hand-in-hand and simultaneously. Just as people of the

developing countries have begun to have rising expectations for the economic and social well-being of their children, they have also begun, we believe, to learn that constant discomfort and debility owing to endemic diseases, recurring paralyzing epidemics, unsafe surroundings, lowered resistance and poor physical condition resulting from malnutrition and undernutrition, and early death are not humanity's inevitable lot.

The statistics of health and disability are an undramatic but necessary part of the efforts to improve health.

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